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JULY, 1944

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FRONT COVER ILLUSTRATION: Caterpillar Diesel tractors, with Le Tourneau bulldozers, upper left and right center, at work on the Wolf Creek Dam project near Jamestown, Kentucky.

TABLE OF CONTENTS ILLUSTRATION: Powered with a 200 hp. supercharged Cummins Diesel, this heavy duty Kenworth tractor with extra wide semi trailer is hauling 20,000 board feet of pine logs at Lakeview Logging Company's operations in Oregon.

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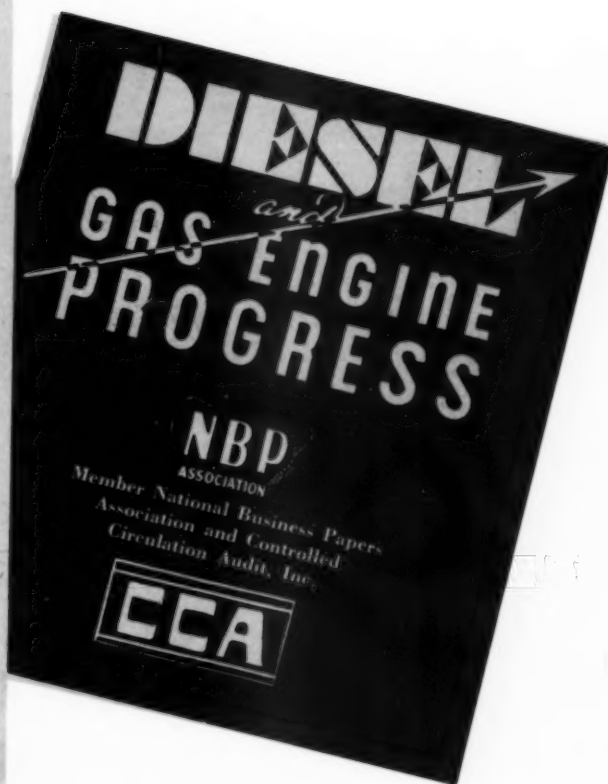
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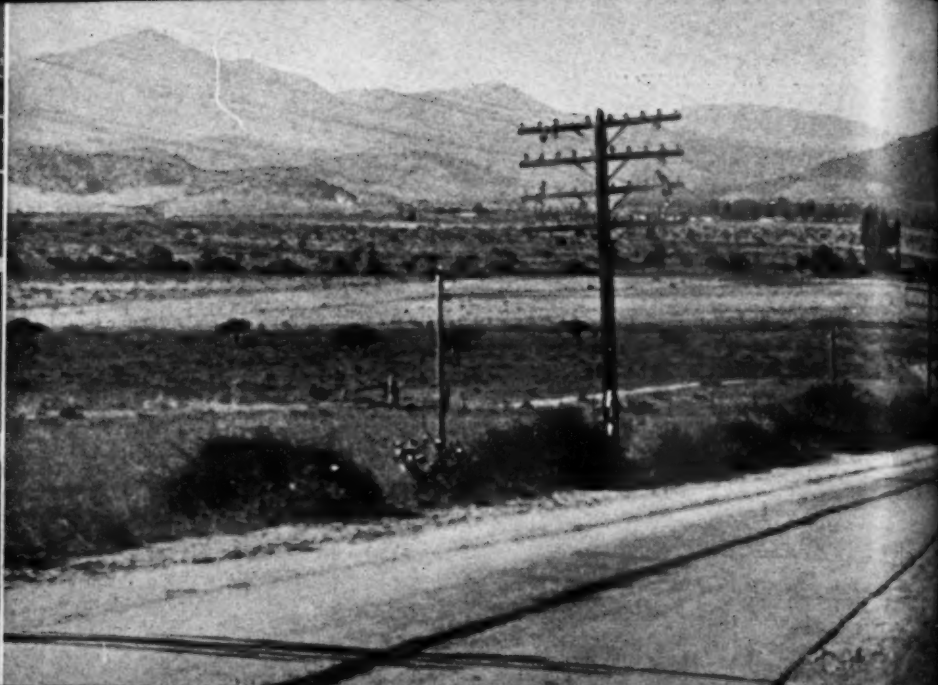
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*Statue of Christ the Redeemer in the Andean Peaks of the same name.*



*The Pan American Highway near Santiago, Chile.*

## PAN-AMERICAN HIGHWAY GOES FORWARD WITH AND FOR DIESELS

By BENNETT E. SMITH

**S**O MUCH attention has been given the Alaskan highway of late, many do not realize that there is another great highway, as important, stretching southward from the southern boundary of the United States, through Mexico, Central and South America. It is the Pan American highway and is being built as a war measure for the better transportation of supplies and troops in cases of emergency and for the opening of stores of valuable minerals yet untouched. It may be considered an extension of the Alaskan highway and when completed, will form an all-year highway extending from Alaska, across Canada and the United States down to the Southern tip of South America.

The small nations of the southern republics are great store-houses of valuable minerals and supplies—mercury, nickel, mica, antimony, tin, manganese, rubber, and silk—but transportation to put them to use has been a great drawback. The airplane has been the greatest means of transportation but the new highway will provide a much-needed supplement. The illustrations show the part Diesels are playing in this project.

Conceived in 1923 at a conference of American Republics in Santiago, Chile, the highway got under construction in 1930 and was originally

planned to connect the capital cities of the southern republics. With the coming of war, efforts were speeded up for such a highway would mean the better and more rapid transportation of troops and materials for protection of the Panama Canal, our southern sea coasts, and our neighbors on the south.

The United States War Department approved the building of the highway in June 1943. Already the Public Roads Administration had a project under way for which \$20,000,000 had been appropriated to complete the road through Central America provided one-third of all expenditures were made by the countries themselves. Much work had previously been done in the southern countries toward better roads but most of these were not suitable for all-weather travel and for the strenuous use expected of them. Many miles needed resurfacing, some routes needed changing, and new construction needed completion. The United States undertook the completion of the task and the spurring on of the work.

The highway has a minimum width of 16 feet and, since it is a military project, it will be extended to 22 feet for distances of 4000 feet at intervals of every four miles. Surfacing is of crushed rock or gravel. In some sections, nota-

bly in Peru where the highway is completed, 70 per cent is of asphalt and is perhaps the best section on the whole route. In many places the survey ran through jungles and many natives were engaged to cut away the dense growth. It was necessary that practically all transportation of workers to and from camp was either on horseback or on foot, so bad were traveling conditions.

All available modern road building machinery has been called into use but in many places the crudest hand labor has been employed. Culverts were either of corrugated iron or of concrete. Bridges were built either of native lumber sawed and hewn on the job by native workers or constructed in and shipped from the United States. Nearly 100 such bridges ranging in size from 50 to 100 feet were thus supplied.

Rain along the route in many places has caused delay. In some sections rain fell for days and the ground became so soaked that even tractors could not operate. All work in Mexico is being taken care of by that government. The whole highway project is under the supervision of the Corps of Engineers, United States Army, and the Public Roads Administration. The cost has been great. Loans from the United States have totaled \$767,000,000 and have gone into the

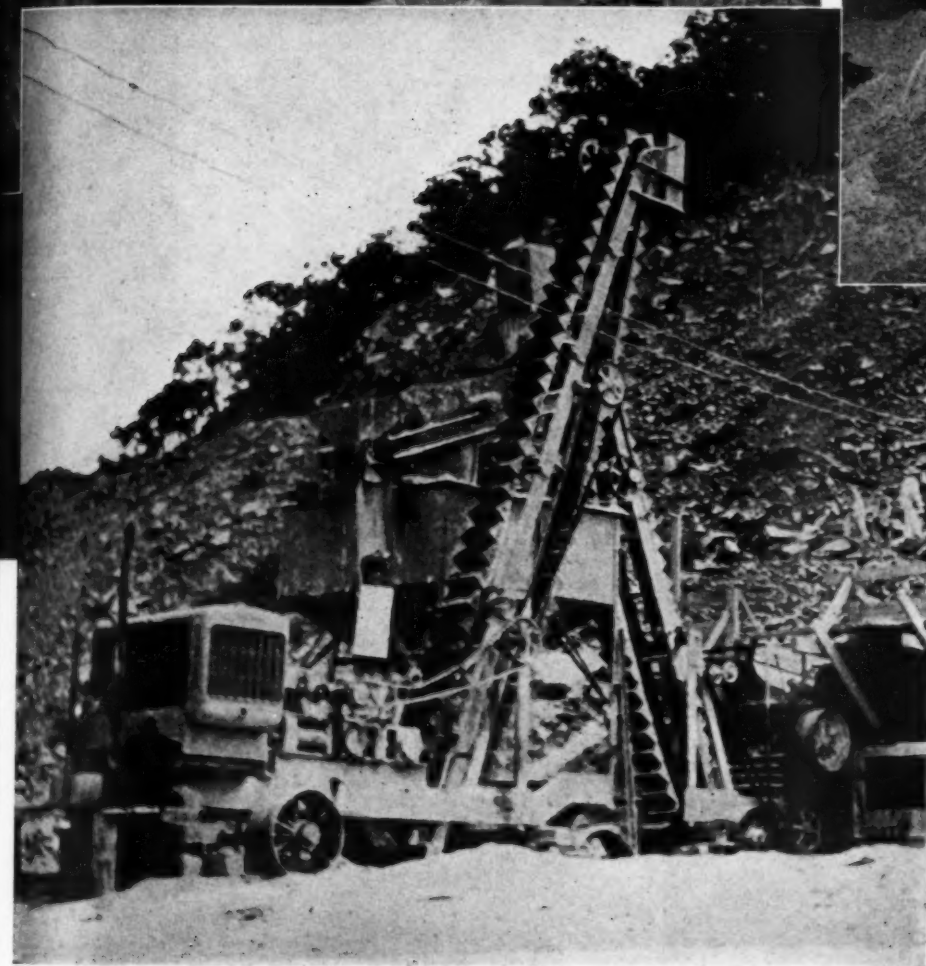


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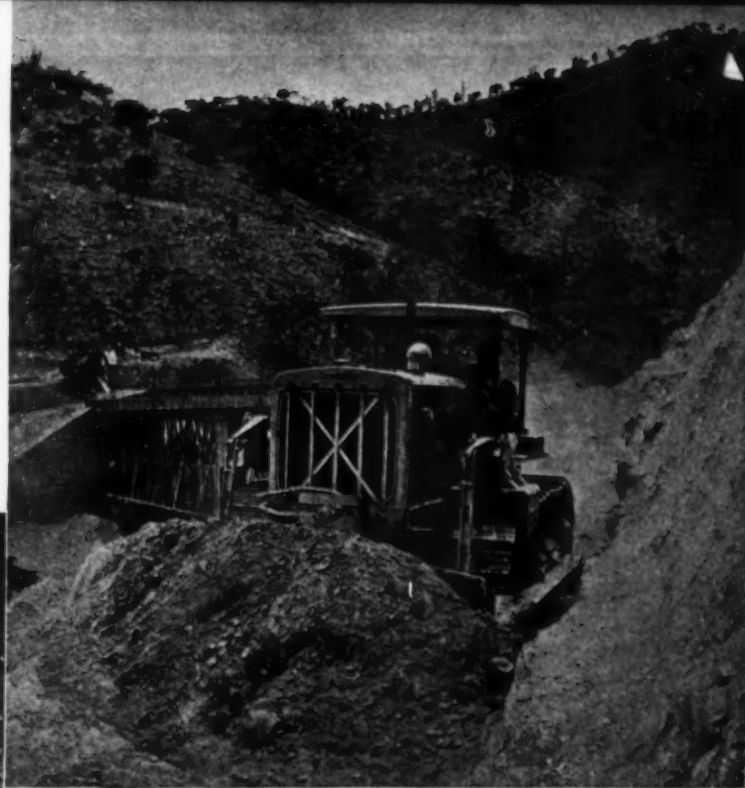
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*Universal crushing plant powered by Caterpillar Diesels between Huajuapán and Oaxaca.*



*Making a side haul on the Pan American Highway with a Caterpillar Diesel tractor.*



*Cutting the Pan American Highway through Mexico, north of Tapachula.*

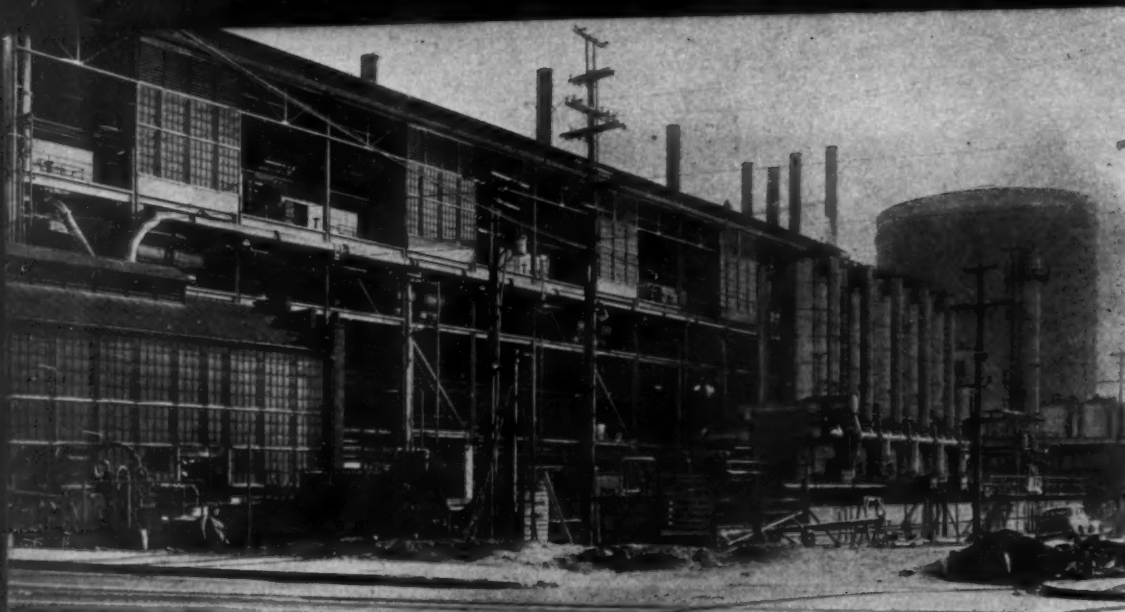
construction of new roads and improvement of old. In addition, many millions of dollars have been appropriated by the various republics.

The friendliest feeling exists between the several countries and the United States. Every effort is made to assist, not only in construction but by the passing of supplies, free of duty, and the furnishing of equipment when available. But one should not be misled. The Pan American highway is far from completed for

general travel and, while 90 per cent is finished, the remaining 10 per cent traverses great mountains, valleys, and some of the most difficult terrain of the whole route.

When it is possible for the traveler to make the trip, he will pass through a picturesque country where many of the people are living about the same as did their ancestors of hundreds of years ago; he will see lofty mountains with their snowy caps; he will pass burned out

volcanoes and will travel through dense jungles and across arid deserts. The tourist will see black panther, jaguar, the dangerous wild hog, and other animals which abound there, so much so that those in charge of construction of the highway named the territory "the Martin Johnson country." It will be a real trip but it will have to be reserved for future years, for the pleasure seeker, but meantime thousands of Diesel trucks will roll over its long reaches with vital cargoes.

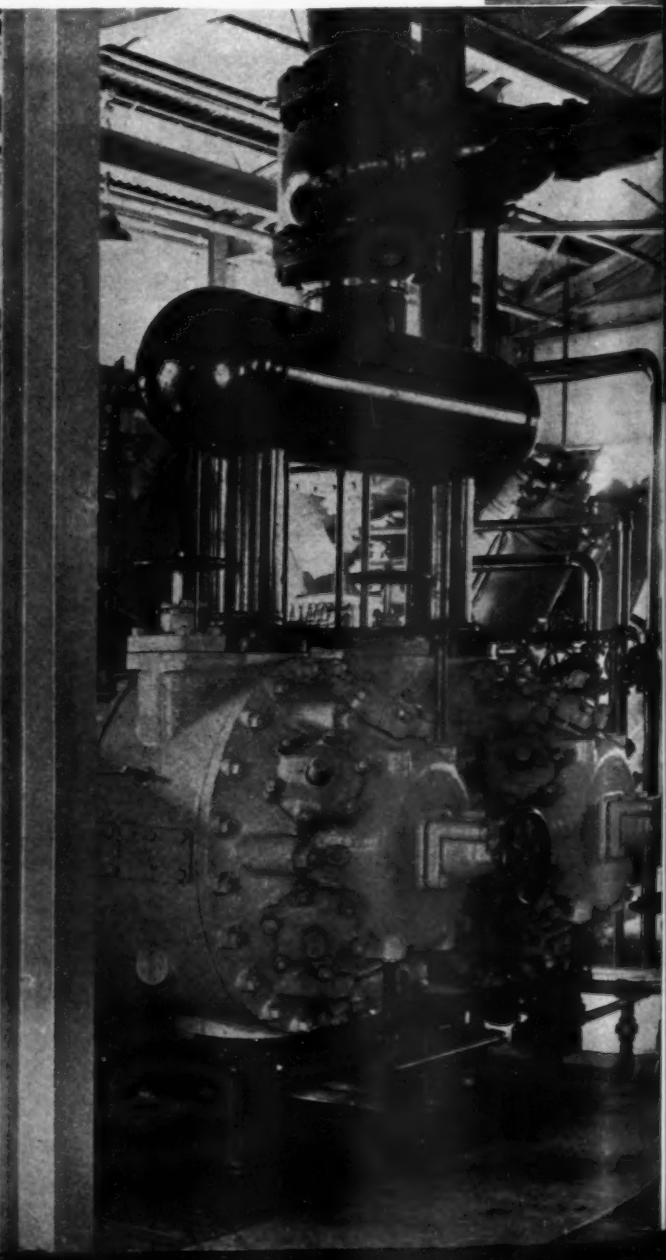
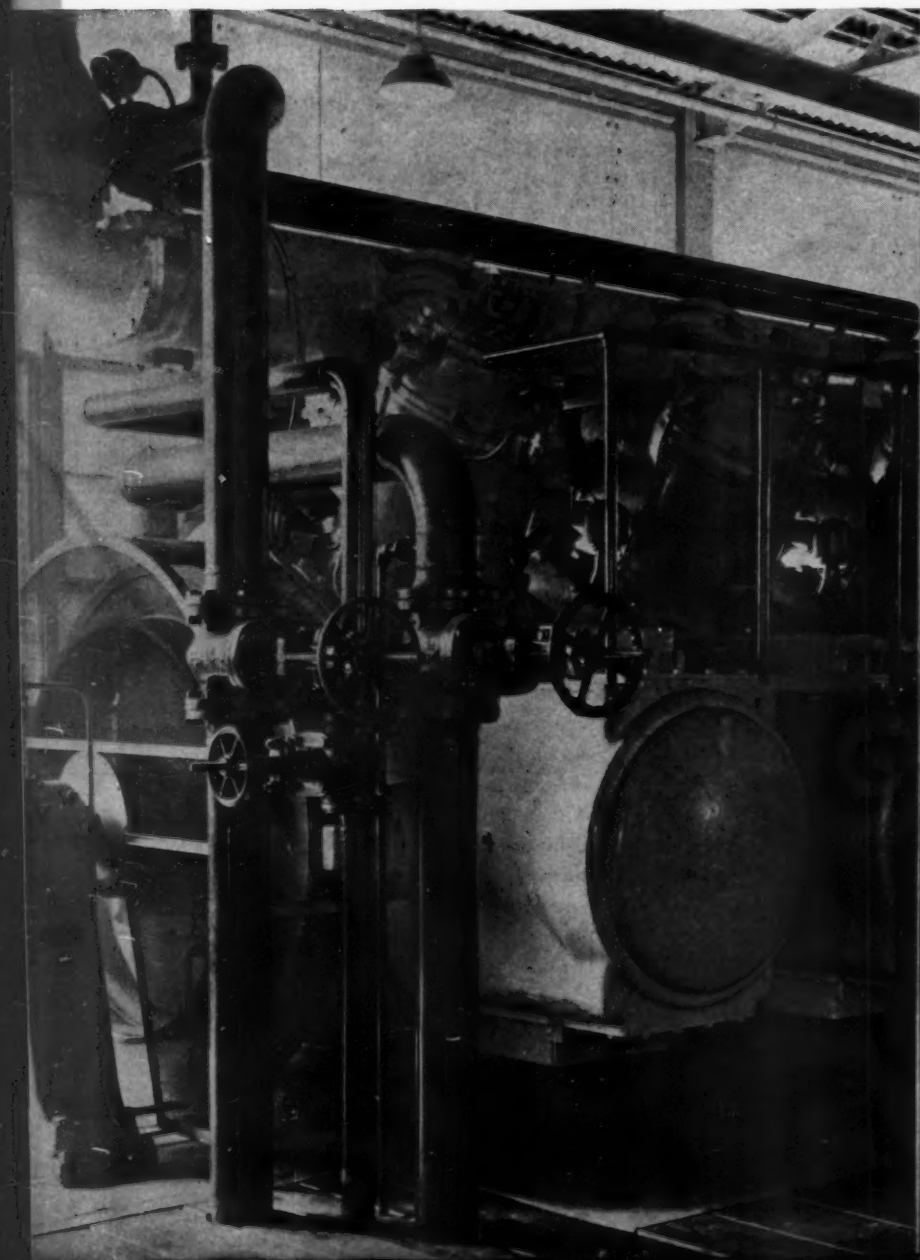


*View of the Southern California Gas Company Plant, converted last year to the manufacture of butadiene; capacity 35,000 tons a year.*

## **GAS ENGINES MAKE SYNTHETIC RUBBER**

*By JIM MEDFORD*

*Close-up of a Cooper-Bessemer gas burning angle compressor unit. Lower portion of Fluor air jacketed exhaust silencer is seen upper left.*

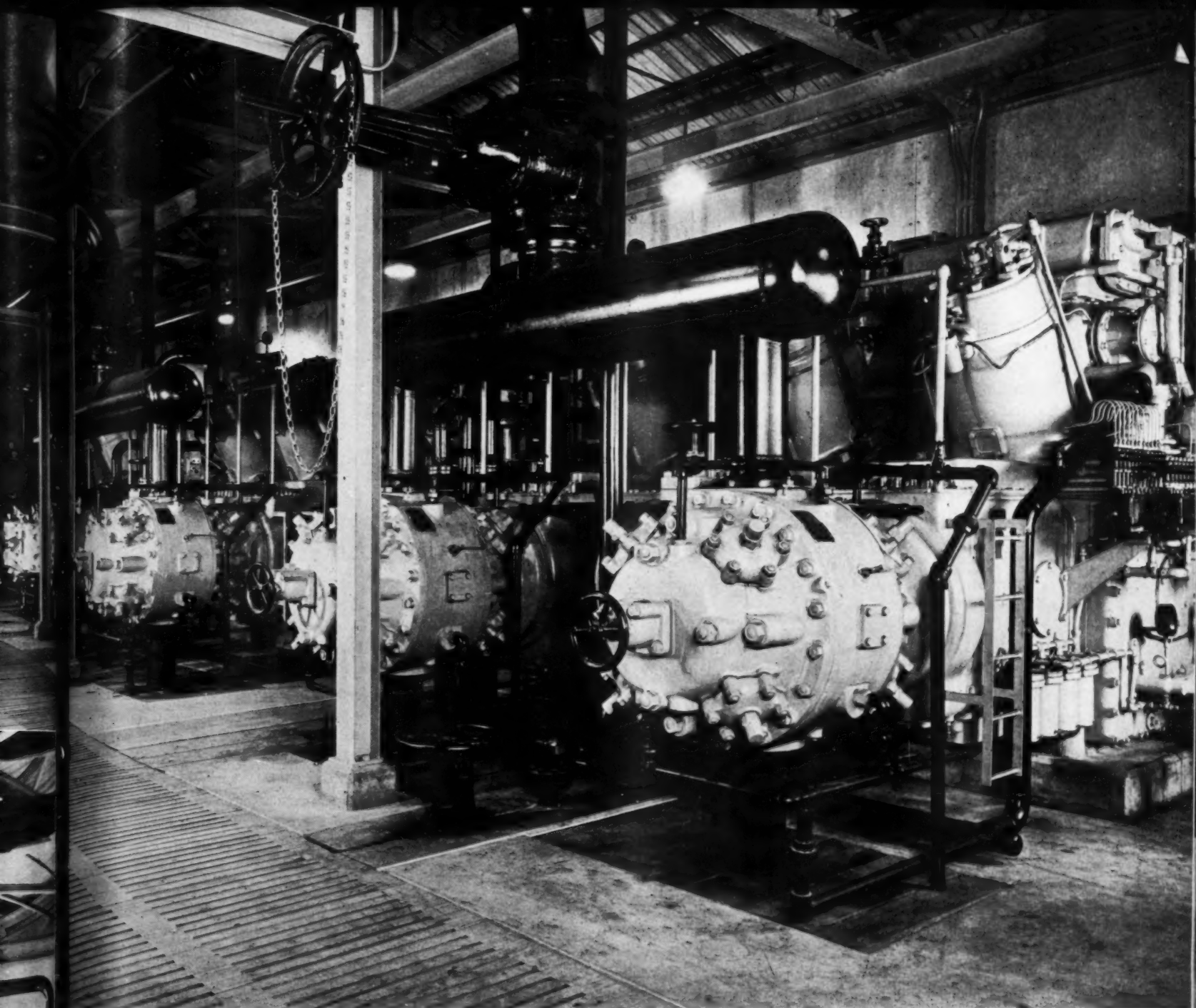


**M**ANUFACTURE  
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*View of one bay of the engine house showing four of eight Cooper Bessemer angle compressors.*

**M**ANUFACTURING Buna-S involves the production of raw materials, butadiene and styrene, and the polymerization with a catalyst under heat and pressure. Neither butadiene nor styrene exists in nature. Both must be made synthetically or derived from related materials.

To supply these raw materials in the enormous quantities required by the synthetic program, many chemical and oil companies are rapidly adapting and enlarging plant facilities and constructing new plants. These producers will use many different methods, each producer choos-

ing the method which is best suited to his materials, processes, experience and location. One of these adaptations is that of the Southern California Gas Company, where, in addition to installation of a battery of gas-engined angle compressors, have completed an additional installation of multiple heat exchangers that have overcome the escape of offensive fumes by the proper cooling of the butadiene-bearing gas as it emerges from the generators.

Butadiene from petroleum will be used for the balance of the program, and that is what we are going to talk about.

Styrene is made from ethyl benzene by removing hydrogen in dehydrogenation apparatus. Ethyl benzene in turn is made by combining ethylene and benzene. Benzene is made by distillation of coal tar. And it is also derived from petroleum. Ethylene is a by-product of petroleum.

Other raw materials required for Buna-S manufacture include millions of pounds of plasticizers, anti-oxidants, catalysts, inhibitors, soap and special chemicals. Production of each of these items in sufficient quantity presents its own special problem.

The raw products are measured and fed into a solution in approximately the proportions of three parts of butadiene to one part of styrene. The butadiene and styrene are then emulsified, or whipped into small droplets in a water solution.

Next is polymerization—the temperature is raised and a catalyst is added to speed up the process. In polymerization the original molecules of butadiene and styrene hook up together, to form giant molecules. As the polymerization proceeds, the materials become more viscous, or thicker, and more rubber-like.

Then flocculation—The droplets are now converted to the form of solid flocs or crumbs of synthetic rubber. They rise to the top of the solution and are screened off.

Last is finishing—The flocs are then washed, the excess water is pressed out and the material is dried and baled.

Because we are all interested in this new synthetic rubber, let us return for a minute to the third step in the process, where rubber forming really takes place—polymerization. And in case you are not the one bright fellow in the crowd who knows how to pronounce it, it's "p'lim-er-ization." A homely example of polymerization is the drying of paint on any surface. This polymerization increases viscosity, or thickness with respect to ability to flow. For instance, butadiene in its monomeric state, before polymerization, is a gas. When it is polymerized it first becomes a liquid, but if polymerization is continued it becomes a solid.

Now that Buna-S is selected for the major part of the government's synthetic program, let's look into how it's made up: The word *Buna* is a coined word, the *BU* is the first syllable of butadiene; *NA* is from natrium, the classical name of sodium the original catalyst. The letter *S* stands for styrene. Buna S is the synthetic most similar to natural rubber in processing and performance characteristics. And because Buna S must be compounded with carbon black, you won't get any Buna S white sidewalls for the old family bus.

For the preparation of the raw materials that go to make our now understandable Buna S, natural gas engines play an important part. The Southern California Gas Co. installation is of eight units—two 8-cylinder, four 6-cylinder and two 4-cylinder—rating 100 hp. per cylinder at 300 rpm. for a total of 4800 hp.

These Angle compressor units manufactured by

Cooper-Bessemer handle the wet gases produced by the plant. From the main generators the wet vapors are compressed to intermediate pressure and piped to a 266,000 cubic feet Hortonsphere.

Fitted with identical power cylinders, 14" x 14 inches, the compact engine-compressors operate on natural gas consuming approximately ten cubic feet of gas per brake horsepower hour. All units are designed to operate on 50 pounds suction and 200 pounds discharge, compressor end. The compressor cylinders are in pairs—13x14 on the 800-hp. units, and 15x14 and 17x14 on the 400's and 600's respectively. Two cylinders are so piped that they may be switched from wet gas to propane when required.

Speed control is automatic on six of the eight engines by means of a pressure controller operating on suction pressure. As the suction pressure increases, engines automatically speed up. On the decrease of pressure, engines automatically reduce speed. This pressure controller provides a variation of 50 per cent in the quantity of gas handled.

Speed of engines range from 150 to 350 rpm. on six of the engines. Due to fluctuation of pressure in the Hortonsphere, this speed range is necessary to maintain constant pressure to the compressor end. The other two engines, eight-cylinder 800 hp., have constant-speed hydraulic governors. In designing the plant, six engines on variable speed was considered sufficient flexibility for all plant requirements.

Ignition system is of two types—battery and magneto. Battery energy through automotive type interrupters or distributors are on all variable-speed engines. On the constant-speed engines, ignition is supplied by two rotary magnetos on each unit, one for each bank of power cylinders, and gear driven from the auxiliary drive shaft. Impulse couplings are built into the magnetos to intensify ignition for starting. An overspeed safety device is built into the engine flywheel and operates a switch for grounding the magnetos and shutting down the engine should speed become excessive. It is set for 350 rpm., fifty over the standard rating of 300 rpm.

Simple, yet economical, the fuel injection system operates through a governor-controlled gas valve, located at the entrance to the gas manifold, that varies the amount of fuel admitted to the manifold to meet any change of engine load. The gas manifold, with flanged joints, is cast integral with the exhaust manifold, eliminating pipe joints. This manifold is located

between the two banks of power cylinders with separate connection to each cylinder.

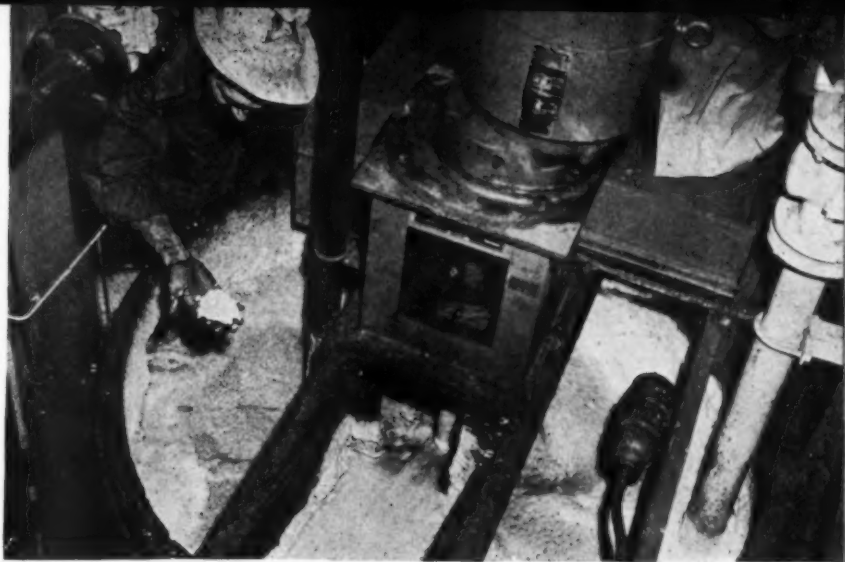
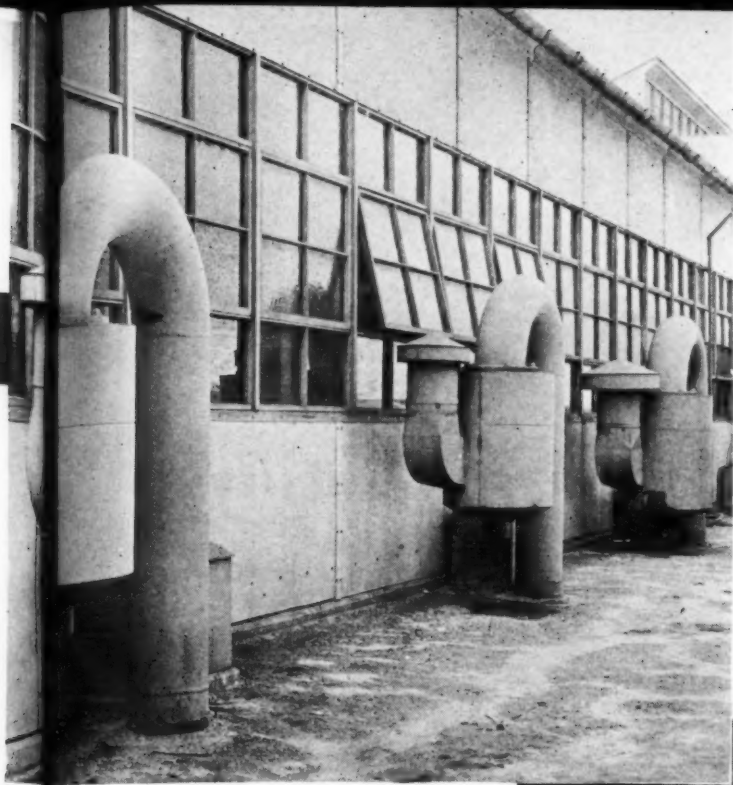
Located in the center of each cylinder head, a mechanically-operated injection valve is actuated by a push rod operated directly by an adjustable cam on the crankshaft. Port design of this fuel injection valve affords easy and accurate regulation of the amount of fuel supplied the cylinder insuring efficient operation with fuels of high or low Btu. content. Thus equal load-balance of cylinders is constant.

This valve has a specially designed port which vents gas directly toward the spark plug and into the flow of combustion air, to provide an instantly combustible fuel mixture that fires under any load. A movable valve head adjusts the gas flow from Btu. content or to balance load between cylinders. This means that the clearance between valve stem and tappet is not interfered with in adjusting for gas flow, insuring minimum wear and continued silent operation. This, coupled with efficient low-pressure air scavenging, makes constant maximum power with minimum fuel consumption and maintenance.

Full-flow, pressure-type oil filters are installed in the oil lines between the lube oil pump and the oil cooler, all oil passing through the filter. Of the blade type, cleaning is a matter of twisting handle on top of filter.

The cooling-water pump is of the centrifugal type, built-in and driven by two vee-belts with idler adjustment and circulating 25 gallons per bhp.-hour at normal speeds. Discharge is





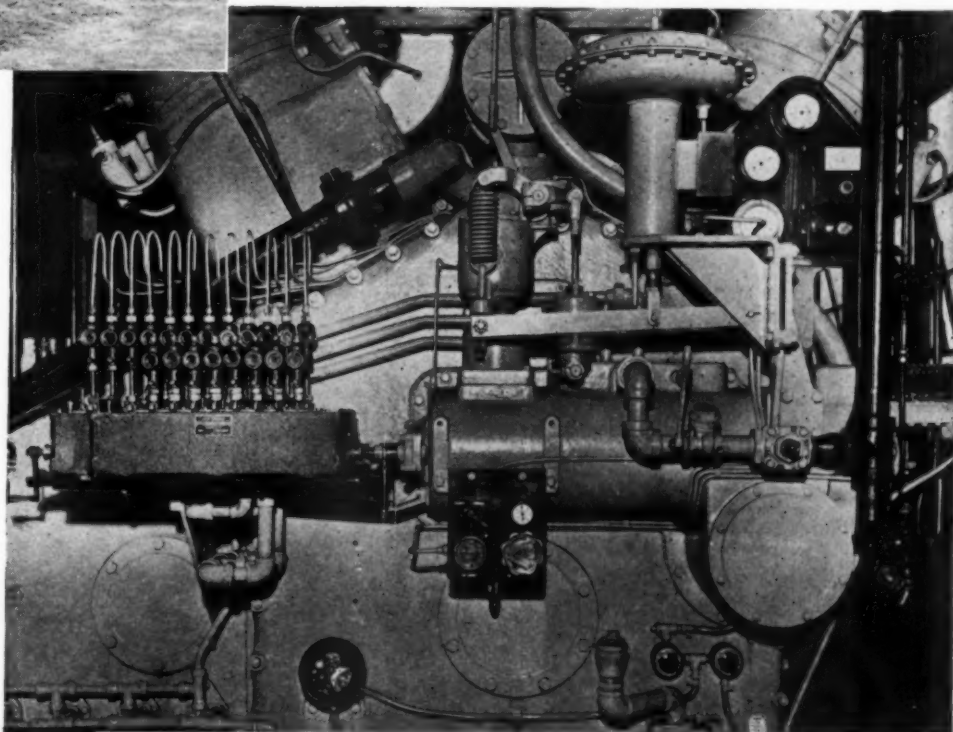
Synthetic rubber latex comes from blending tank to coagulation unit where acidified latex forms into rubber crumbs.

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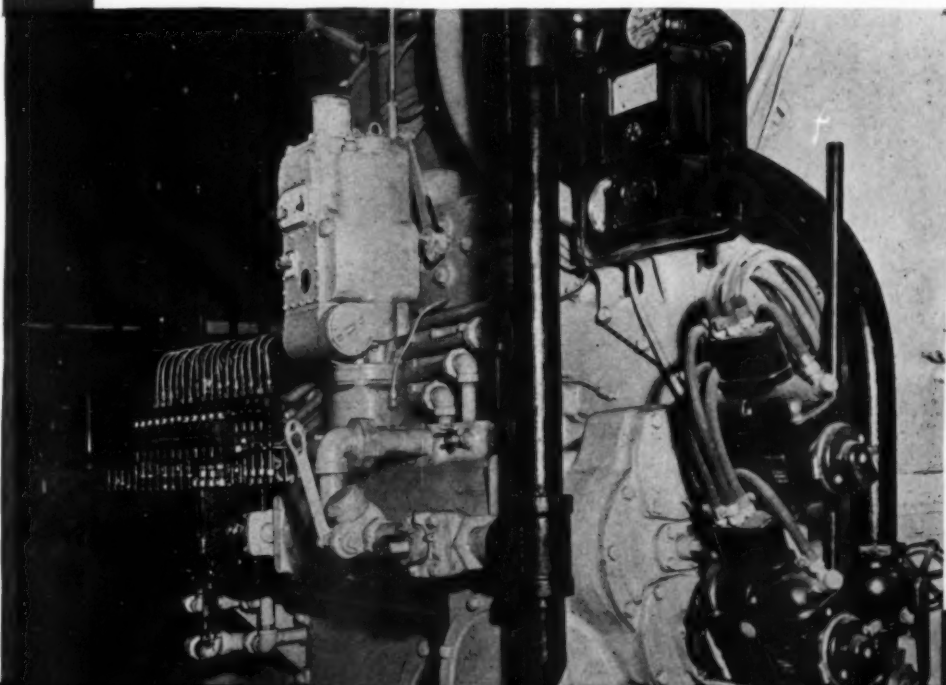
under head, a through the lube oil cooler and beyond into the  
lve is actu engine cooling system by means of multiple  
ectly by an heat exchangers of the unit type for ease of  
Port design temperature control. Cooling water system for  
ds easy and the compressor end discharges into atmospheric  
of fuel sup cooling tower. The engine inlet water header  
nt operation supplies the compressor cylinders through valve-  
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is constant.

Engine exhaust is silenced through air-cooled  
port which mufflers employing the simple jet design, where-  
k plug and by hot exhaust gases in the exhaust line are  
provide an released within and below an outside stack,  
e that fire causing an induced flow of air in the air duct  
head adjust encasing the exhaust line. High air velocities  
e to balance are obtained in the air duct providing positive  
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appet is not lower stack, engine room and floor tempera-  
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In addition to the Cooper-Bessemer installa-  
tion, other equipment items include: Pickering  
mechanical and hydraulic engine governors;  
ingersoll-Rand compressor with G-E motor for  
starting air; Nugent and Cuno lube oil filters;  
Ross and Braun heat exchangers; U. S. Gauges;  
Mercoide lube oil pressure/temperature switch;  
intake air filters by Vortex; exhaust silencers  
by Fluor; exhaust pyrometers by Alnor; bat-  
eries by Hobbs; switchboard and gear by  
Braun; instruments by Foxboro and Marsh;  
valves by Walworth; impulse coupled magnetos  
by Bendix-Scintilla; McCord lubricators; Ham-  
mel-Dahl gas mixers; Reliance tachometers.

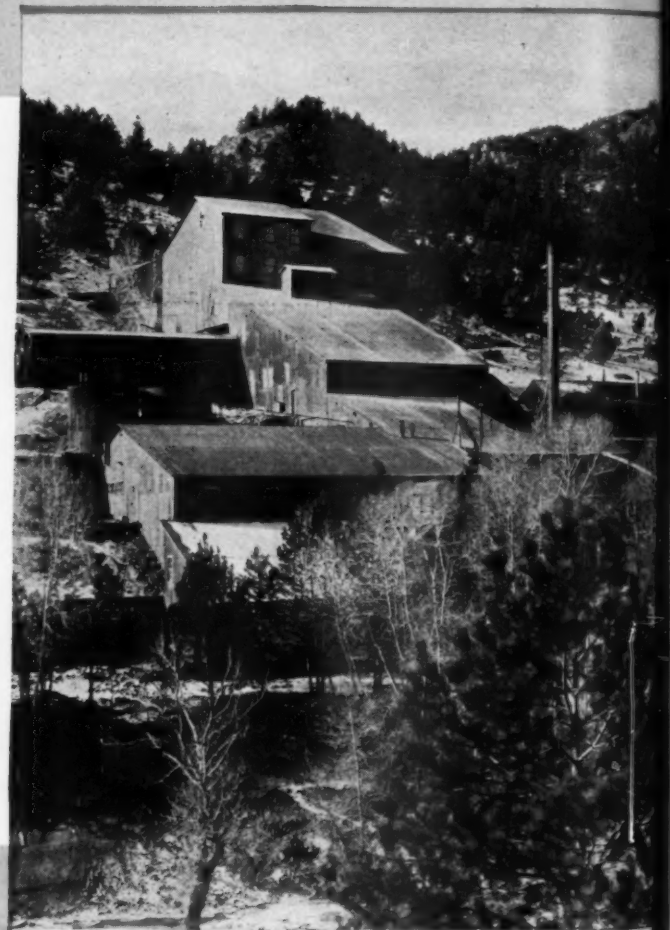
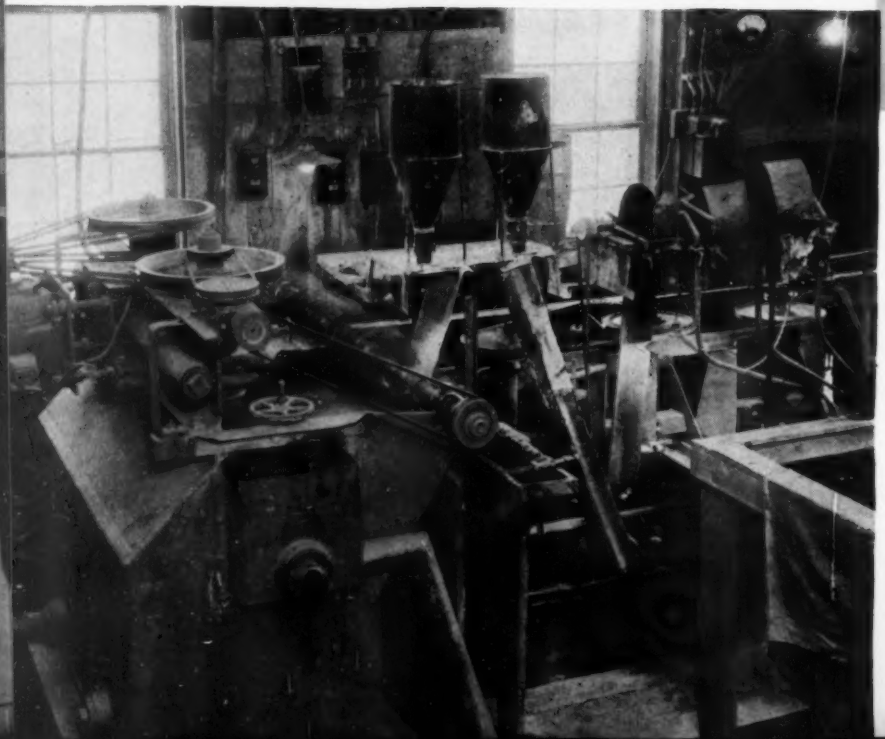
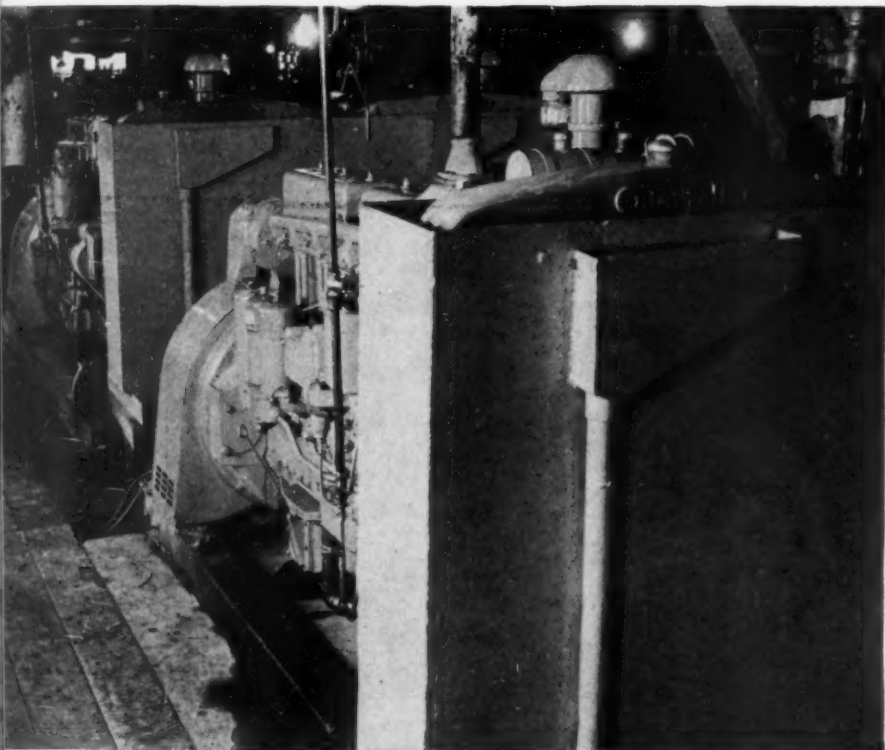
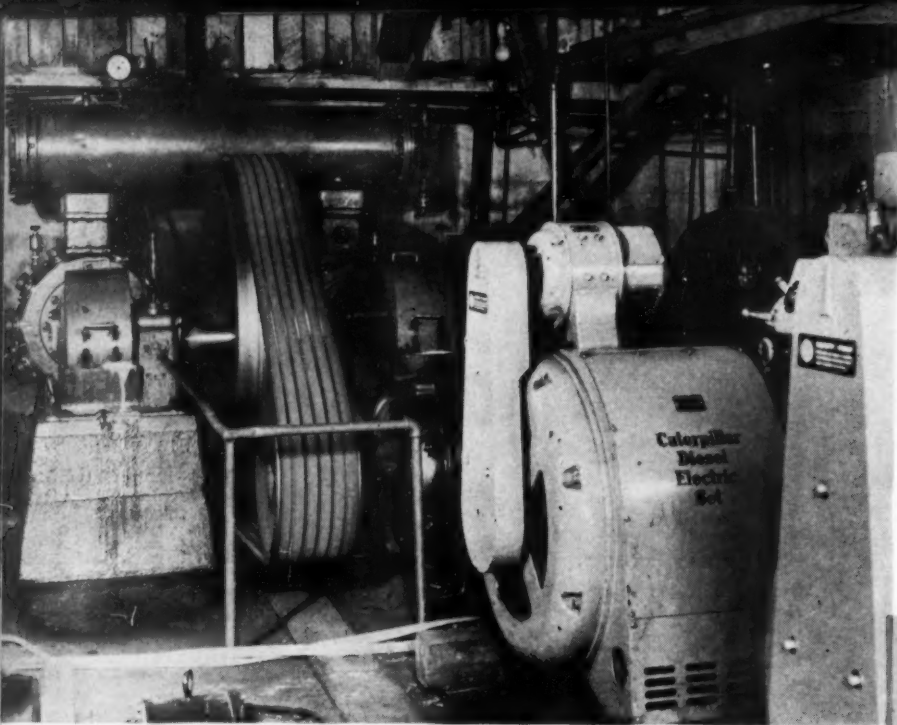


Above: Grouped on each angle compressor unit are, McCord lubricator, left. Pickering governor, center, Reliance tachometer and Alnor pyrometer, upper right, also Mercoide lube alarm control and remote control, lower center. Below: Closeup of Pickering, isochronous governor, the pyrometer and tachometer and Bendix-Scintilla magneto.



## DIESELS VS. AXIS

### FROM THE HEART OF THE ROCKIES



*This mine and mill near Jamestown, Colorado, producing acid fluorspar, used with aluminum in airplane construction, gets its power from three Caterpillar Diesels.*

*Top left: View showing one of the generators, right, and motor-driven air compressor, background.*

*Center left: Two of the Deisel generator sets are seen here. The mill takes 265 hp. and the mine requires 100 hp. These units operate 1 to 24 hrs. a day.*

*Left: This crude looking mill is producing material essential to building the airplanes that are beating the axis. Entire power for lighting and machinery of mine and mill is supplied by Diesels.*





*The LT387 on trial run in Connecticut Bay, top, and her skipper, Capt. J. B. Meagher, at the wheel, above.*

**MOST POWERFUL**

**TACOMA-BUILT**

**DIESEL**

**TUG**

By CHAS. F. A. MANN

**W**INDING up 24 months of intensive production of a big fleet of Army and Navy special type vessels, the 12 busy boatyards at Tacoma are near the end of their work on a half dozen types of Diesel craft for the Government. Over 300 Diesel engines have gone into this Wartime fleet built at Tacoma, and without waiting for more orders from Washington D. C., these yards will proceed at once on a big new batch of orders for large Diesel fishing vessels; reduce back to 10 instead of 12 yards (for all practical purposes), and they are already set up for extensive repair and overhaul orders. Cutback in Government orders is working out in a unique manner at Tacoma, largest boatbuilding port on the Pacific Coast, for not only has the major cutback been effected, but these yards are proceeding almost uninterruptedly into peacetime shipbuilding even before the Invasion Date is set for the European theater of war.

Airplane and Munitions people should take a leaf from the boatbuilding industry of Tacoma—their cutback and reconversion problems are already solved and actual deliveries under the new and somewhat slower pace, will take place before election day.

Last of the large Army tugs to be completed at Tacoma is the LT 387, originally contracted to Puget Sound Boatbuilding Corp. and sub-

let to Petrich Shipbuilding Corp. to even out the Army boat orders in Tacoma—a little co-operative scheme cooked up last Winter that averted a real waterfront explosion among builders there. Of the basic design worked out by L. H. Coolidge of Seattle, this is the single screw version of the 127 foot class of Wood & Diesel ocean-going tugs built for the Army's extensive "Navy."

Allocations of the single and twin screw 127 footers worked out so that the last of them built at Tacoma, happened also to be the cause of installing the largest Diesel ever hoisted into a Tacoma-built tugboat, and to the Enterprise Diesel Engine people of San Francisco went the honors for the job. Not only was it the biggest in horsepower rating, but it was the largest and one of the very first supercharged 4-cycle Diesels to go into a Tacoma-built hull.

The design of the hull follows similar 127 foot Army tugs, and it is 126.8 x 28 x 13 ft. draft aft, heavily built of Douglas Fir throughout. Very large tank capacity is fitted, 30,955 gallons of fuel oil storage in four large main tanks, located fore and aft of the engine room; 916 gallons of lube oil and 3200 gallons of fresh water. Six 96 in. by 30 in. steel air bottles are provided, carrying ample starting air at 250 lbs. pressure for all the elaborate maneuvering any tugboat skipper might require in handling a heavy tow or a big transport.

Briefly the layout begins with a combination paint locker and anchor windlass motor room in the forepeak, directly over the chain locker, followed by a rather undersize foc'sle for 12 men in funny little bunks, followed by the twin forward fuel tanks with passageway connecting the foc'sle and engine room; then the engine room space, containing all pumps, day tanks, main and auxiliary Diesels and battery sets. Aft of the engine room are two more large fuel tanks, and a steering engine and storage flat area aft of this.

The crowded but rather extensive main deck-house begins with a mates quarters for two, connecting with vestibule leading out and up to the pilot house, a roomy galley and mess-room, and connecting via side passage to the upper engine room grating. The upper engine room is again a crowded area with a pair of small staterooms on the port side and large central wash, shower and toilet room for the entire ship on the starboard side and a stateroom for two men besides. The towing machine occupies the 3-sided and roofed en-

closure facing aft, on the main deck.

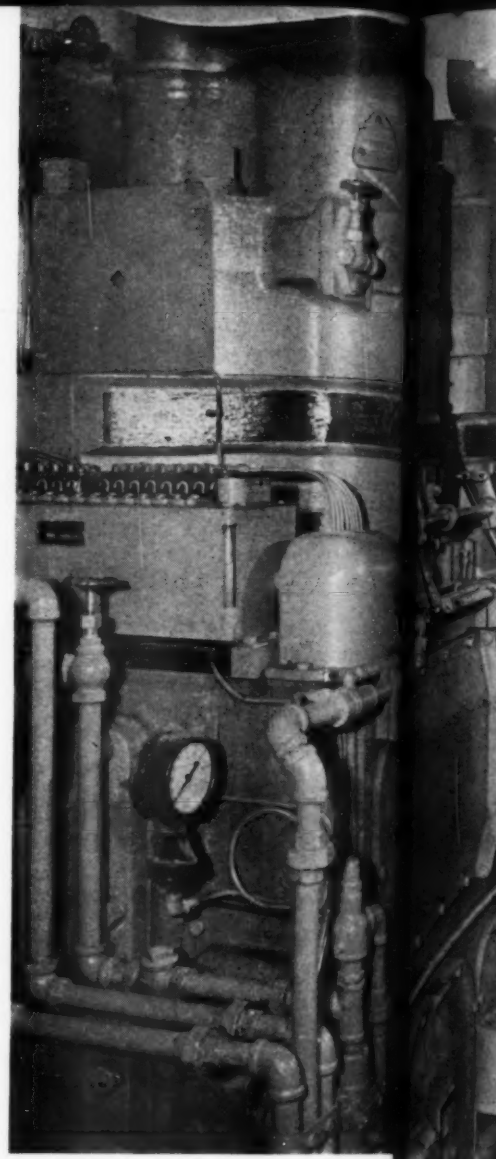
The topside is obviously the design of a Navy admiral, for here nothing in the layout makes sense from the human standpoint. The pilot house is connected to a captain's stateroom and chartroom, and aft of this a commodious "spare" cabin with complete toilet and shower facilities in separate spaces. But, believe it or not the captain of the tug, who stays with his job for a whole voyage, must go outside on the deck and through four doors to wash his face and things, when a simple door on one end of his cabin would solve the rainy weather trek to the bathroom. Besides, mind you, the big spare stateroom will only be used occasionally by random visitors.

The elaborate and splendid mechanical equipment on the LT 387 reads like a Who's Who of the American equipment manufacturers who have literally won the war. Nothing is missing and nothing is included that has not won itself a long peace and wartime rating of superiority.

The big 8 cylinder Enterprise Diesel has 16 x 20 inch cylinders and is of their trunk piston design, developing 1200 hp. at 275 rpm., with the Elliott-Buchi exhaust, supercharger attached. Ingenious slantwise mounting of the supercharger at one end practically adds no width to the big Diesel, and the low overall height is maintained. A special water cooling system cools the Turbobl原因, with Wagner electric motor and a Burgess air intake snubber is fitted to quiet the noise. The Enterprise Diesel is direct reversing; has Bendix-Scintilla injection pumps; a Viking sea water circulating pump; Ross Heat Exchanger; Alnor Pyrometers; Weston Tachometer and Kingsbury built-in thrust bearing. The main propeller is a 92 x 57 inch Doran four bladed bronze wheel machined in Seattle, at the big Doran plant. A Manzel lubricator and Fisher governor is fitted as well as a 25 kw. 125 volt d.c. auxiliary generator, V belt driven (Gates V Belts) from the special wheel on the tail-shaft.

Two 6 cylinder Cummins auxiliary Diesel generator units are fitted, delivering 30 kw. each at 125 volts when turning at 1450 rpm., using Reliance Electric Mfg. Co. generators direct connected. Briggs fuel oil filters for all Diesels are employed as well as a Honán Crane lube oil purifier.

A Wm. Sellers electric steering unit, with Crocker Wheeler 7½ hp. motor is fitted, and



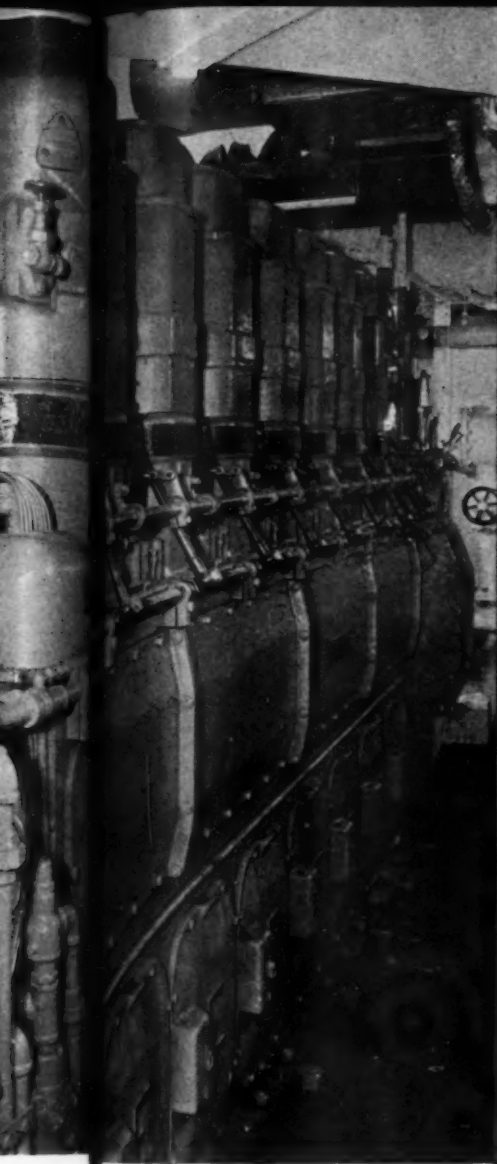
The 1200 hp. Enterprise Main Diesel (Elliott-Buchi turbocharged). Note Manzel lubricator left end of engine.

Cutler Hammer controls and Square D switches included. The main switchboard is a large Westinghouse dead front type with everything on it and back of it, needed to centralize the entire group of ship's control circuits in one convenient spot. The Walter Kidde extinguishing system carries one 50 lb. and four 15 lb. CO2 bottles. The CoTwo Equipment Co. furnished the 15 lb. bottle extinguishers.

Vortex Spark Arrestors by Engineers' Specialties Co. for main engine, and Maximilian's (for auxiliaries only) are fitted as well as a Capitol Sunray oil fired heating boiler, 2 stage Ingersoll Rand main air compressor driven by a G.E. motor and G.E. controls, as well as a smaller I.R. auxiliary air compressor with same control and power equipment. A Deming salt water circulating pump with a 1500 watt Allis motor; Ralph B. Carter fire and general service pumps (2); a Waterous salvage pump, also with Louis Allis motor and a Deming

auxiliary fresh water pump; a Viking water pair of scavenge pumps layout.





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Control stand on the main Diesel with Bendix marine telegraph, Weston tachometer and Alnor pyrometer showing.

Left to right: Martin Jr. and Hervey Petrich, Capt. Meagher and chief engineer Charles E. Glassford.

auxiliary fresh water pump, with Louis Allis motor; a Viking fuel oil and Goulds lube oil pump; a Dayton Dowd sanitary and fresh water pair of pumps and a Goulds lube oil scavenger pump complete the large pumping layout.

The anchor windlass is by National Iron Works, as well as the twin motored large towing machine, all powered by Century motors and with Cutler Hammer controls. The 479 ampere hour storage battery system consists of 14 Exide Ironclad batteries for operation of



One of the two Cummins Diesel auxiliary generator sets on the LT387.

the lighting system only. Two Crouse Hinds searchlights are fitted. Twin Frigidaire units supply the low temperature and cold storage compartments built into the large galley, and a Hughes oil fired range is carried as well as Western Blower Company's ventilating system. A Northern Radio 2-way radiotelephone set and Bludworth direction finder, also Liquidometer Corp. rudder angle indicator are some added items of important equipment.

This big tug represents the highest class of construction and equipment found on any type of American-built ship yet produced and no limit as to its life or range of operation will handicap the Army's far flung operations. These vessels are at home in either the tropics or the Arctic and can remain at sea indefinitely and run 10,000 miles without refueling. Both the Puget Sound and Petrich companies are to be congratulated on producing this latest addition to the biggest Army "Navy" in the world.



*View of the modern Municipal Light and Power Plant, Paragould, Arkansas.*

## PARAGOULD POINTS WITH PRIDE TO ITS DIESEL PLANT

By WILL H. FULLERTON

**A**N OUTSTANDING civic accomplishment has been attained by Paragould, Arkansas, a city of less than 10,000 population. On the first day of spring this year the Commissioners of Paragould's Municipal Light Plant liquidated its indebtedness fifteen years earlier than the scheduled time.

The campaign to build the light plant started about eight years ago, despite the opposition of many people who were fearful that the project would be a bonded burden for the taxpayers of the community. For three years there were extended fights through the courts by those vigorously opposed to the establishment of the enterprise.

Paragould's light and power plant was finally completed and put into operation on January 17, 1939, with an original valuation of \$204,920.38. It was financed as follows:

Bonds of the Municipality	\$100,000.00
P. W. A. Grant	89,920.38
Revenue Bonds of the Plant	15,000.00
<b>Total</b>	<b>204,920.38</b>

In the five years of its operation, additions to

the plant, up to January 17 of this year, amounted to \$34,801.81, bringing the estimated value of the plant to that date to a total of \$239,722.19.

Company records of the annual net profit for each of the five years showed the following:

Jan. 17, 1939 to Jan. 17, 1940	\$17,977.64
Jan. 17, 1940 to Jan. 17, 1941	28,162.36
Jan. 17, 1941 to Jan. 17, 1942	31,799.38
Jan. 17, 1942 to Jan. 17, 1943	25,004.92
Jan. 17, 1943 to Jan. 17, 1944	31,188.78

**\$134,133.08**

The day the plant began operation the electric rates, officials said, were reduced approximately \$14,000 per year, and in addition to this, Paragould's streets were lighted free, and at former rates paid, this amounts to approximately \$6,500 per year.

All of the outstanding bonds against the plant were callable and were called on March 20 of this year and paid for in full from the revenue profits of the plant. The plant, therefore, was paid for within five years although the last of

the bonds was not due to expire until 1958—20 years from the date of the first issue. In addition, plant officials said that there was still \$50,000 cash left over for other purposes.

Dan G. Pepper, plant superintendent, explained that the Paragould rates were the lowest of any city in Arkansas under 10,000 population.

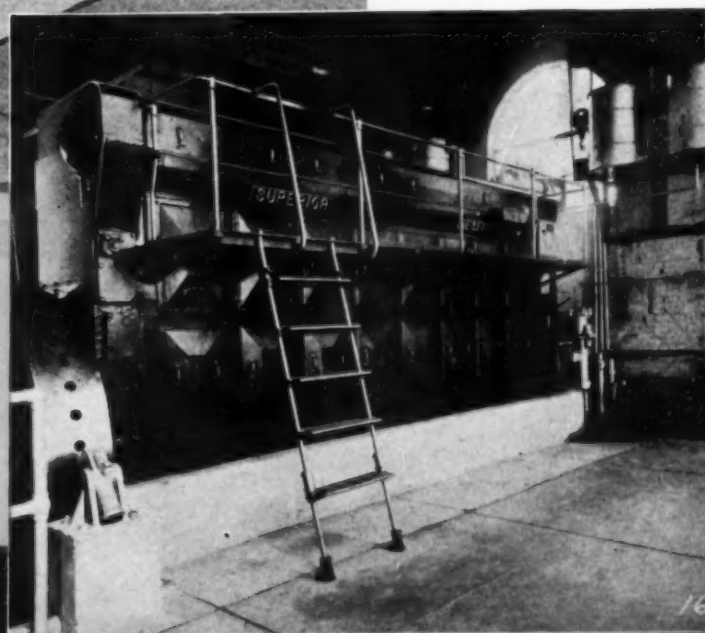
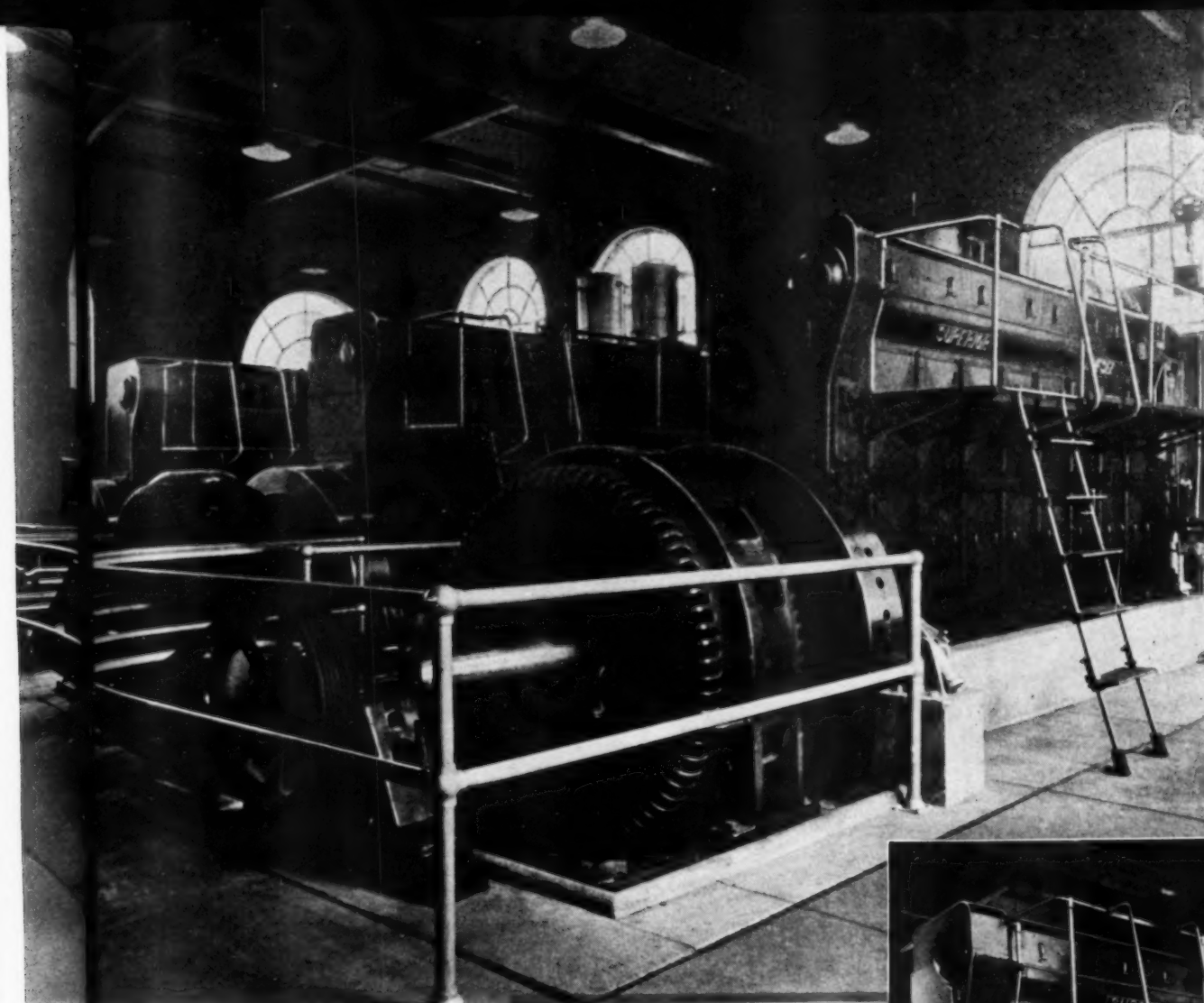
Mr. Pepper explained further that the service from the plant has been without interruption and that more than 80 per cent of the consumers in the city were served by the light plant. The exact population of Paragould, according to the 1940 census, was 7,094.

The plant prime movers are three 620 hp Superior Diesel engines, 400 rpm. directly connected to Elliott generators with a Westinghouse switchboard.

"This equipment," Mr. Pepper explained, "has been in operation throughout the five years without any major service being required."

The light plant rate sheet was outlined by Mr. Pepper as follows:





Above: The three Superior 620 hp. Diesels and Elliott generators at Paragould. Right: Close-up of one of the 8-cylinder Superior Diesels. Below: View of the Westinghouse switchboard and switchgear.

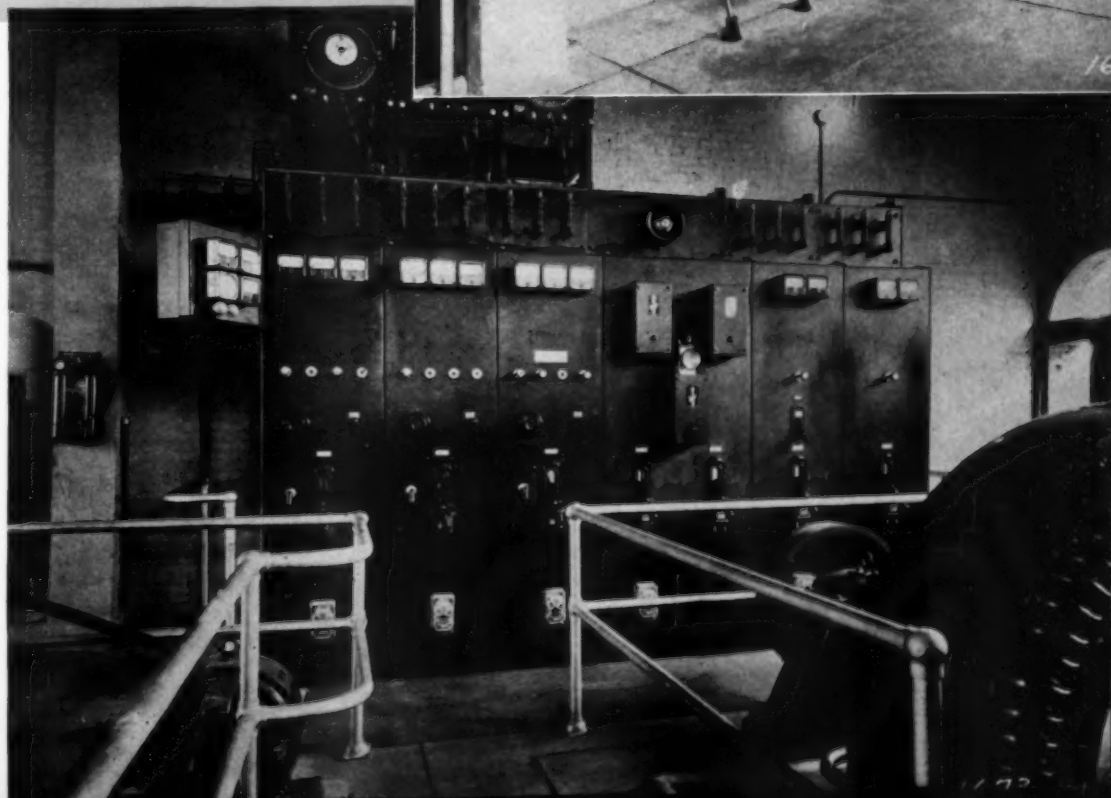
#### Data 1943-1944 (12 m.)

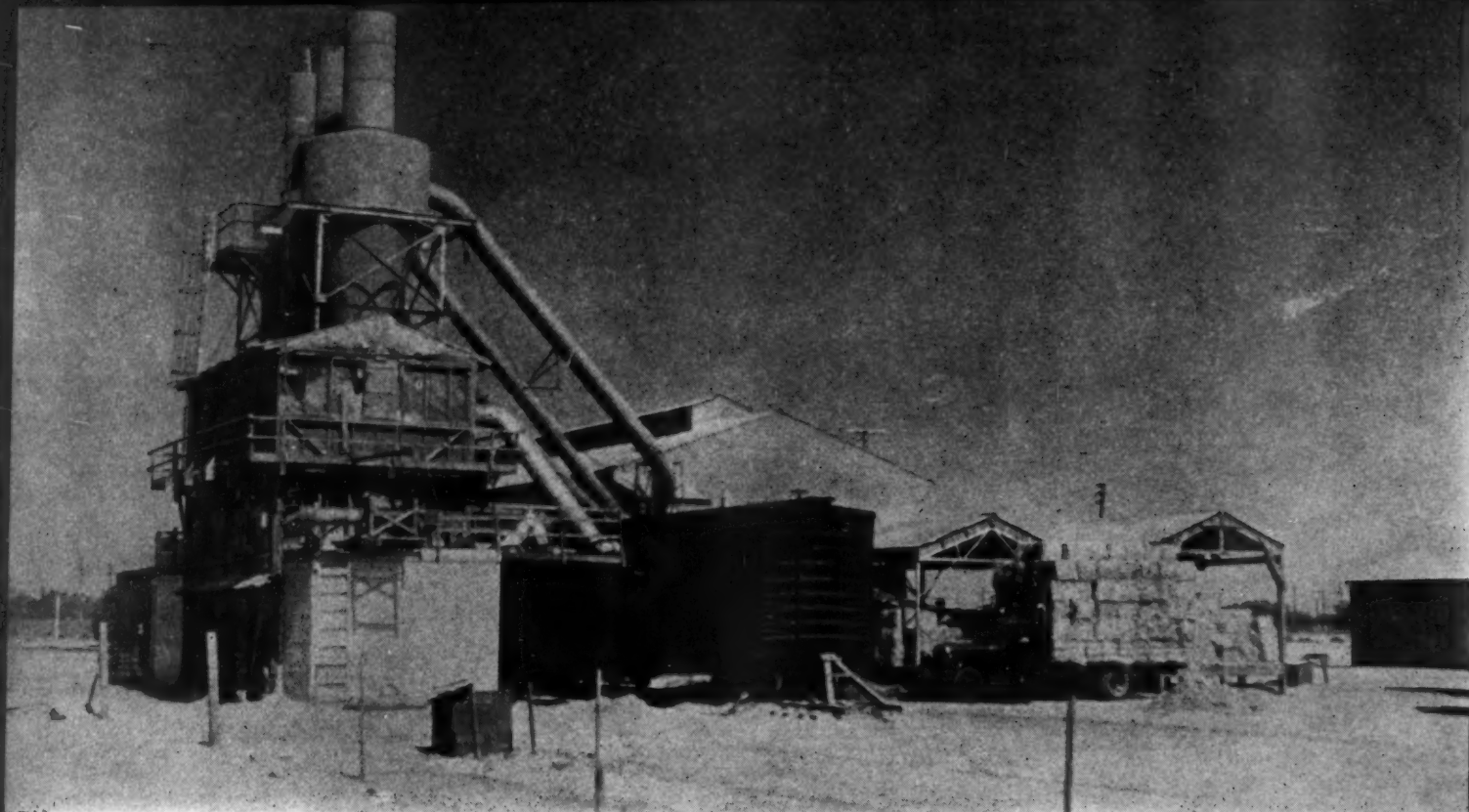
	Kw.Hrs.
Total generated	3,792,200
Used by auxiliary	138,100
To system	3,654,100
Billed to consumers	3,371,854
Line loss or unaccounted for	282,246
Gallons fuel used—302,768 gallons at \$0.499 gal.	
Lub. oil used—4,866 gallons	
Total engine hours—13,662	

The Light Plant Commission is composed of the following: J. C. Ford, Chairman, Joe Shelby, Donald Cox, H. W. Woosley, and O. M. Atkins.

A deserving tribute to the men who fought the bitter opposition for this plant known as Paragould's "greatest civic asset" was made by the Paragould Daily Press as follows:

"The Board of Commissioners and their faithful associates deserve the congratulations of the citizens of the community for the very fine record achieved. The plant appears to have been given progressive, intelligent administration"—and the machinery appears to have given a good account of itself.





*This raw flax processing plant at Ey Centro, performs the first operations in preparation of cigarette papers.*

## DIESELS LIFT FLAX CROP TO HEIGHTS

By F. HAL HIGGINS

**C**ALIFORNIA farmers will pocket an extra million dollars from their record flax crop because they grow a variety that yields more oil than does the flax grown in the Mid-west. It gets a 25-cent premium at the market because of this high oil yield. And wars are fought on oils for both machines and men. Flax is a comparatively new crop in California. Commercially it started less than ten years ago in the Imperial Valley with a single variety—punjab—developed there by the U.S. Department of Agriculture and the University of California after tests of leading varieties from all areas of the flax-producing world.

The Imperial Valley being the leading Diesel tractor farming area of the state from the standpoint of size of tractor, or horsepower per operator, the crop has been a Diesel-ized

one from the start. With over fifty different crops grown on a commercial scale in the Imperial Valley, flax had to prove its place in a highly competitive field. Flax has since spread out over considerable areas in the San Joaquin Valley, but in the Imperial it has literally gone to war. Over 140,000 acres of flax were grown there this year with Diesel tractors making the seedbed, seeding and handling many combined harvesters. In addition, Diesel trucks for transportation of the seed from bulk combines came on the scene to haul the flax seed from field to storage elevators and freight cars on the sidings. All combined to make the flax crop one of the most profitable to the grower of anything on the list of war needs.

All the farm authorities your Old Reporter visited in the Imperial Valley when he was

down there to look in on the flax harvest agree that the big Caterpillar, International and Allis-Chalmers Diesel tractors so numerous in the Valley are the key to low cost and sure results. As one put it, "One skilled operator on a big Diesel tractor produces more food than a thousand men with hoes in Victory gardens anywhere else." The only kick these Imperial Valley farmers have with the war situation is the limiting of Diesel tractors and the big farm implements and machines they power.

They could use twice as many as the Washington Bureau Boys permit them to have. But next year they will raise more flax than even in this record year. They could increase food production 25 to 33% if the Government would take off its Diesel tractor hobbles, they all agree.





*This Diesel-engined combine harvester is loading flax seed onto a Mack Diesel truck and trailer as the outfits move through the field.*

*Another view of the big Mack Diesel truck. The lugging ability of Diesel equipment enables it to get out of irrigated fields with capacity loads.*



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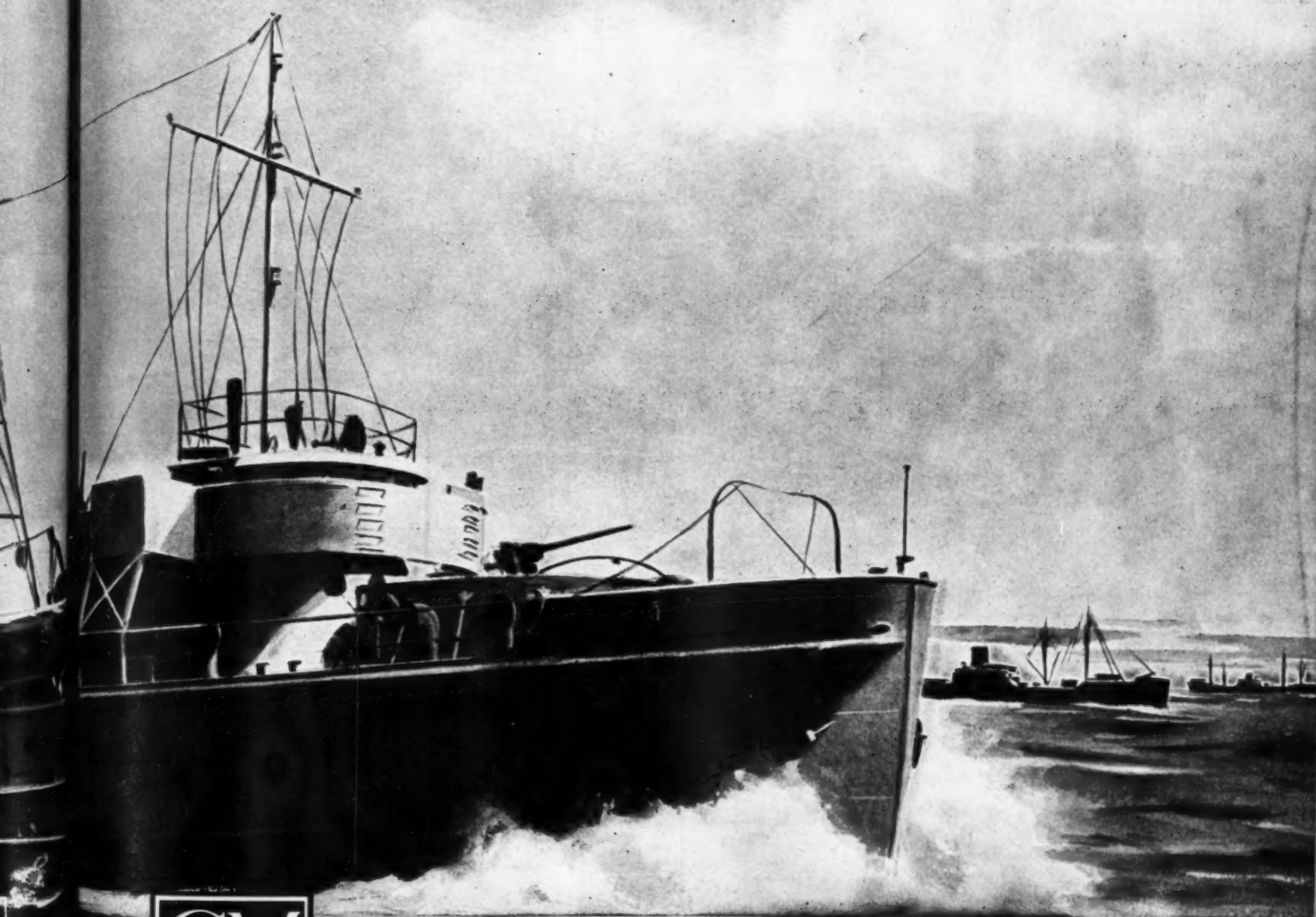
# LIFEGUARDS OF THE

● These capable craft dog the wakes in the supply lanes ready to rescue luckless stragglers and tow them to safety. ● Already they've saved millions of tons of shipping. ● No ships must be more dependable—none more able to keep steadfastly at it. ● Both the American and British Navies have fleets of these deep-sea Diesel-Electric rescue tugs—powered by General Motors Diesels. ● And these engines are turning in the same reliable performance which shipowners all over the world know so well.

**KEEP AMERICA STRONG  
BUY WAR BONDS**



# S OF THE CONVOYS



**GM**

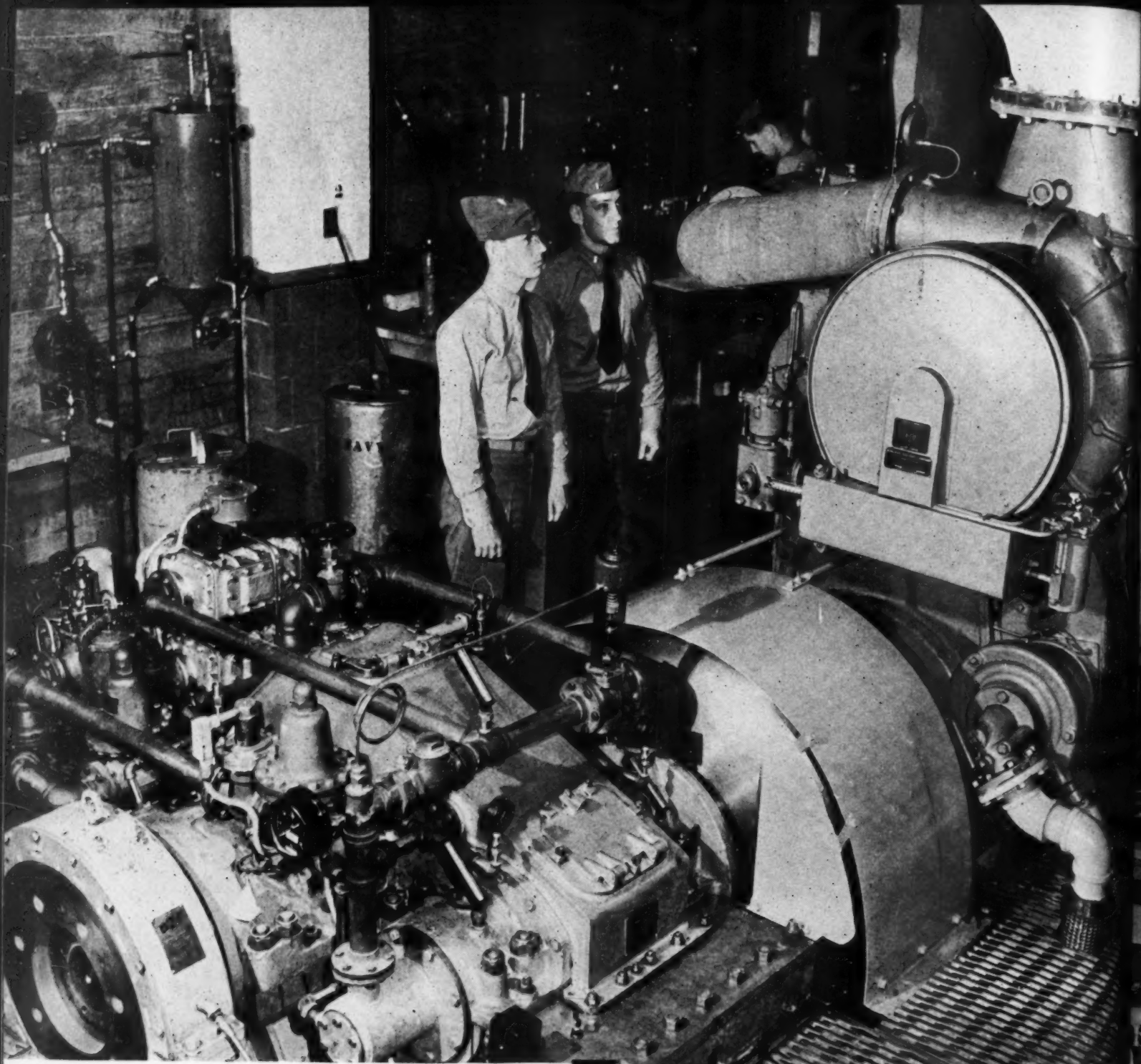
GENERAL MOTORS

**DIESEL  
POWER**

**ENGINES...150 to 2000 H.P. CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, O.**

**ENGINES.....15 to 250 H.P. DETROIT DIESEL ENGINE DIVISION, Detroit 23, Mich.**

**LOCOMOTIVES.....ELECTRO-MOTIVE DIVISION, La Grange, Ill.**



*One of the Diesel engine dynamometers in North Carolina State College's Diesel Engineering School. Two Navy ensigns are seen inspecting the supercharger and Burgess intake snubber, right.*

*This huge fountain, beside being decorative, cools jacket water from the collection of Diesel engines installed in the school at Raleigh, N. C.*





# MODERN DIESEL ENGINEERING SCHOOL DEDICATED AT NORTH CAROLINA STATE

By MACK WEBB

**A** NEW and modern Diesel engineering building, one of the finest and best equipped structures of its kind in the nation, was dedicated May 27 at North Carolina State College, Raleigh, N. C.

More than 100 of the nation's leading industrialists, engineers, educators and top-ranking Naval officers were on hand for the program, and Rear Admiral E. L. Cochrane, USN, chief of the Bureau of Ships of the Navy Department

in Washington, termed the building "the most modern and complete Diesel teaching laboratory ever assembled in the world."

The building was erected at a cost of around \$200,000 by the State of North Carolina, with the Navy providing the equipment; and Admiral Cochrane, in his dedication talk, declared that "the inculcation of practical lessons like this one will make the \$2,000,000 which the Navy is investing in engines and other equip-

ment here in this school pay dividends many times over the cost of the capital investment."

Declaring that "the role which the Diesel engine is playing in the ships of the Navy today is one of the most important chapters in the story of our entire war effort," Admiral Cochrane said that "the chief responsibility for supplying the Navy's needs of the future for reserve engineering officers" will be in the hands of N. C. State College, Cornell University and the Amphibious Diesel Engineering School at Flint, Mich. "The men who will be trained here at North Carolina State College," he said, "will be chiefly concerned with the operation and maintenance of Diesel installations in types of Naval vessels other than landing craft—submarines, destroyer escorts, mine craft, patrol craft and auxiliaries."

Another speaker at the dedication exercises was George W. Codrington, general manager of the Cleveland Diesel Engine Division of General Motors Corporation.

Others taking part in the program included: Dean L. L. Vaughan of the N. C. State College School of Engineering; Prof. R. B. Rice, executive officer of the Department of Mechanical Engineering; Lieutenant Commander John H. Smith, commanding officer of the Diesel Engineering School at N. C. State; Dr. Frank P. Graham, president of the University of North Carolina; and Governor J. M. Broughton of North Carolina.

Special guests included: Dean George J. Davis, of the University of Alabama School of Engineering; Dean Lee H. Jackson of the University of Mississippi; Captain J. L. Holloway, director of training of the Navy's Bureau of Personnel; Commander A. M. Loker, Lieutenant Commander W. F. Bullis and Lieutenant Commander B. O. Delaney, all of the Bureau of Ships.

N. C. State College has been training Naval officers in Diesel engineering since March 31, 1941, and the new building, in which Diesel engines from the smallest to the largest types in Naval vessels have been installed, will enable the training program to be expanded. The college is one of two in the nation to be selected by the Navy for the intensified Diesel training program, the other being Cornell University.



*Left: This modern building, dedicated May 26, houses \$2,000,000 in Diesel engines and equipment for training Navy Diesel engineers. Below: Installing a G.M. Diesel, the students working with supervisors; note Marquette governor on engine.*



# TORSIONAL VIBRATION

For the Operator, Owner & Builder

By TRESPCOTT S. WHITE\*

**T**HE important subject of torsional vibration, usually cloaked in the language of mathematicians and designing engineers should be thoroughly understood by every boat owner or operator, as well as by ship builders and installation engineers. This article is written for the purpose of conveying to men in this category what is meant when told a boat has criticals."

A working knowledge of the fundamentals of torsional vibration can be obtained by anyone, although only a few specialists know, and need to know, the extremely elaborate and detailed technique of making the actual calculations. However, any man who handles a wheel, or sets an engine speed, should understand the subject and its relation to his particular ship.

It should be first understood that every reciprocating engine has torsional criticals which refer to speeds at which it is either unsafe or noisy to operate. Criticals are found in every boat operated by reciprocating engines, gasoline, steam or Diesel. Sometimes these criticals are below operating speeds and therefore passed through too quickly to be noticed. In other installations, the criticals may be above the operating range, and as they are never reached, escape notice. However, when the critical falls within the operating range, this "rough spot" may break the shafting or at least create objectionable vibration.

In order that this condition may be more graphically understood, it is well that the two charts printed here be studied before going further with the subject. Both show the torsional characteristics of some typical marine engine installations.

In Figure 1 the torsional conditions are shown for a long shaft installation, such as found in purse seiners, tuna clippers and similar vessels. Long shaft means that the shafting is long and of fairly small diameter as compared to shafting used in tugs, towboats and tankers. Often the shaft diameter in a long shaft installation is the minimum size permitted by the American Bureau of Shipping Rules. Note that the operating range of this engine from 150 to 400 rpm.

\* Engineer, Enterprise Engine & Foundry Co., San Francisco, California.

is completely free of all torsional criticals. At 100 rpm., there is a rough spot, or critical, but this may be easily passed through quickly.

However, if this boat engine were operated continuously at 100 rpm. the following conditions would result: a noisy gear train, knocking at the stern bearing, a fairly evident shaking of the entire ship, and the heating and possible breakage of the intermediate shaft at a point about midway between the engine flange and the tail shaft flange. It is therefore apparent that in order to prevent serious damage, operation should be avoided at engine speeds where excessive vibrations are experienced.

Figure 2 shows the torsional stress and critical speed conditions for a typical short shaft installation, such as is used for tug boats, tow boats, trawlers, draggers, tankers, etc. In order to keep major criticals out of the operating range in this type of vessel it is necessary to increase shafting diameter considerably above the minimum requirements of the American Bureau of Shipping. As shown in the curve on this chart, the operating range 0-400 rpm. is free from dangerous criticals. Above 440 rpm., or around 450 rpm. the noisy conditions indicative of torsional vibration would be noticeable. There might also be a small amount of noise at 240 to 250 rpm., but as this is not a major critical, the stress in the shaft is not excessive.

From a review of the information plotted on these two charts it is evident that with the proper selection of shaft diameter, the worst criticals are either forced to a spot considerably above the operating speed, or to a point safely below the lowest operating speed. With the determination of torsional stress and criticals now an exact science, alert engine builders are glad to advise the proper intermediate and tail shaft diameters to produce the best possible conditions for a particular installation.

In addition to rendering this advisory service, the engine manufacturer should supply each owner and operator with a curve chart similar to the ones reproduced in this article. In representative cases the manufacturer may also send a technician with special equipment to the vessel and measure the size and location of the



The author

criticals while underway. Even if this is not done, the research engineering department of the engine company will appreciate advice as to speeds at which excessive vibration is encountered.

Before discussing the cause of torsional vibration, it should be borne in mind that all shipboard vibrations are not caused by this factor. Many kinds and types of criticals develop in a vessel which cannot be corrected by modifying shaft diameters.

A stern post of excessive width and blunt non-faired edges may result in a vacuum around the propeller blades at certain speeds. This condition, known as cavitation, will produce a hull vibration and stern bearing knock which appears very similar to a torsional critical. The same condition can be caused by a bent or unbalanced propeller blade. In some vessels, a swaying of the engine from side to side on its foundation when starting or slowing down may appear to be caused by shaft torsionals, but in reality is a result of foundation stiffness. Finally, it should be understood that each individual part of the ship has a vibration period of its own, but fortunately these are usually far above operating speeds and are therefore only slightly evidenced and seldom noticed.

Some types of non-torsional vibration may be objectionable. This will be found true in vessels with steel hulls where the pilot house roof, or deck, or some other fairly large panel or piece of equipment such as a fire pump vibrates noticeably at certain engine speeds. The remedy in these instances is to add a stiffening angle member to the panels showing excessive vibration.

We now come to the question "Just what is a



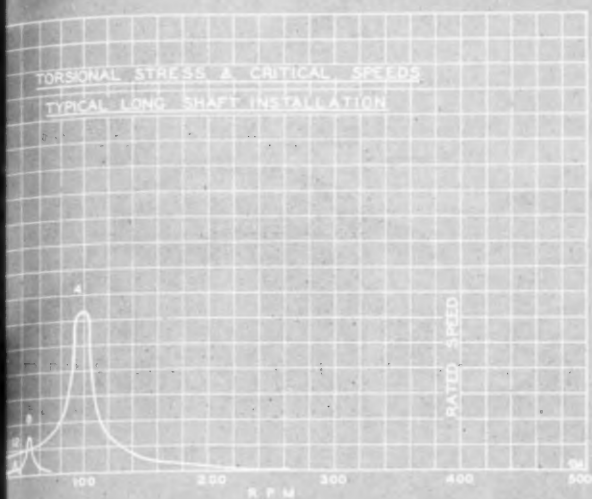


Fig. 1

torsional vibration?" It is best described as a winding up and unwinding of the crankshaft. Every time a cylinder fires the shaft twists to some degree and each time a cylinder comes up on compression the shaft untwists. Thus, in every engine there is a tendency for the shaft to wind and un-wind.

Consider the subject in this manner. Suppose the propellor of the ship is held in a vise while the front end of the engine shaft is twisted and then released quickly. The shaft would, on release, twist to a degree in the opposite direction. For the sake of illustration, we will assume it twists in the opposite direction  $\frac{1}{4}$  of an inch. As it unwound from this position it would twist in the original direction of the twist  $\frac{1}{2}$  of an inch and then to the opposite side  $\frac{1}{4}$  of an inch and continue in this motion until it finally comes to rest.

The speed with which the shaft twisted back and forth is called its natural frequency, or normal speed of vibration. An instrument attached to the front end of the engine could measure this frequency. However, if the length and diameter of the shafting, and data on the engine and propellor are available, the speed of the twists can be calculated with a great degree of accuracy.

Two definite facts are now established. One is that every shaft tries to wind and un-wind each time a cylinder fires. The second point is that every application has a particular frequency, or speed of vibration which is common to that particular installation.

The problem of overcoming damaging or objectionable criticals simply involves choosing an operating speed so that the number of firing

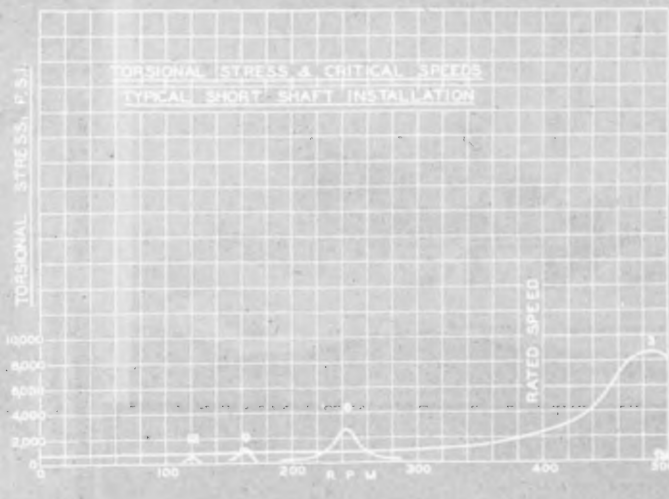


Fig. 2

impulses per minute does not agree with the system's natural frequency, or of changing the natural frequency of the system so that it is different than the number of firing impulses per minute.

In actual practice the engine speed is generally determined when the engine is specified, leaving shaft stiffness the only factor that can be changed. However, shafting-length is also determined by the type of vessel, leaving only the diameter of the intermediate and tail shaft for consideration. If unfavorable torsional conditions are encountered, the diameter of the shafting can be changed. Fortunately, a relatively small change in shaft diameter results in a great change in the natural frequency. Because of this fact, it is usually possible to arrive at an arrangement that is torsionally satisfactory. The determination of the proper shaft diameter is an important consideration that cannot be overstressed. It is the key to overcoming the adverse operating effects of torsional vibration.

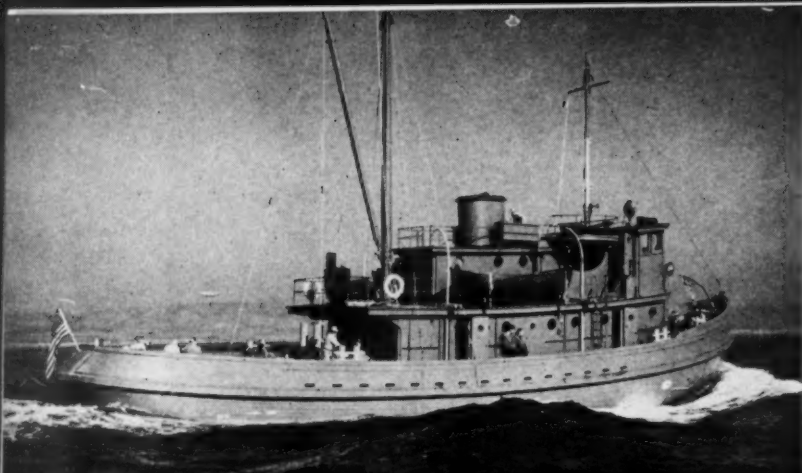
The boat builder needs to understand the following salient points about torsionals which are summarized as follows: Keep major criticals out of the operating range. To get them above the maximum speed use as light a wheel as possible (that is with low flywheel effect or  $WR^2$ ), use the shortest possible shaft, and use a relatively large shaft diameter as the diameter has a greater effect than either propellor weight or shaft length.

To keep criticals, or excessive torsional vibrations, below the operating range, use as heavy a flywheel as possible, the longest shaft possible and as small a diameter as will safely carry the normal horsepower load. The builder should

have the engine manufacturer check American Bureau of Shipping rules for the recommendation on the smallest shafting that can be used as shafts below their specifications are not desirable.

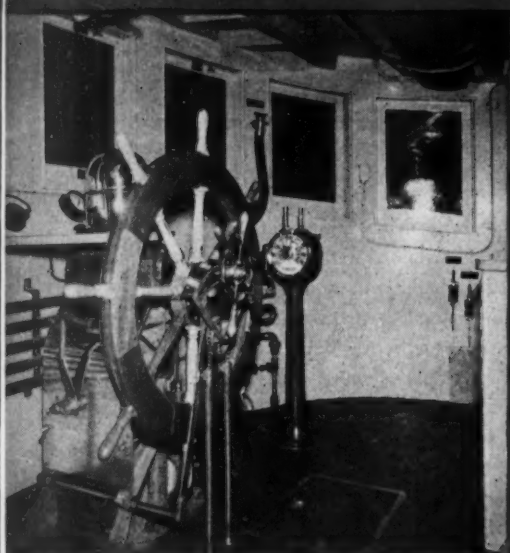
Many boats, due to the nature of design and work they perform naturally fall into a "long shaft" class where with comparatively small shafting diameters the major criticals are kept below operating speeds. Many tugs and towboats require only a short shaft length that does not need too large a diameter. However, there are a few tugboats of the larger sizes where the shaft length falls between these two. The procedure in cases of this type is to adopt one of the two following alternatives: (1) use a medium-sized shafting and accept a torsional critical at some spot within the operating range, but agree not to operate the boat at this speed, (2) arrange to use especially large shafting, of possibly a tubular type.

The first alternative, keeping the critical at some point such as midway in the operating range is accepted and used by many operators of vessels as freight or passenger ships where the only two speeds employed are "full ahead" and "dead slow." However, the alternative of using a larger diameter shaft is becoming more frequently employed. The extra difficulty of providing for exceptionally large shafting when building the vessel is more than compensated for by an operating range free of criticals. This article is of material benefit to the boat builder, owner and operator and should be filed for future reference. Questions concerning the torsional conditions of present equipment, or vessels either being built, or planned, should be referred to the engine manufacturer.

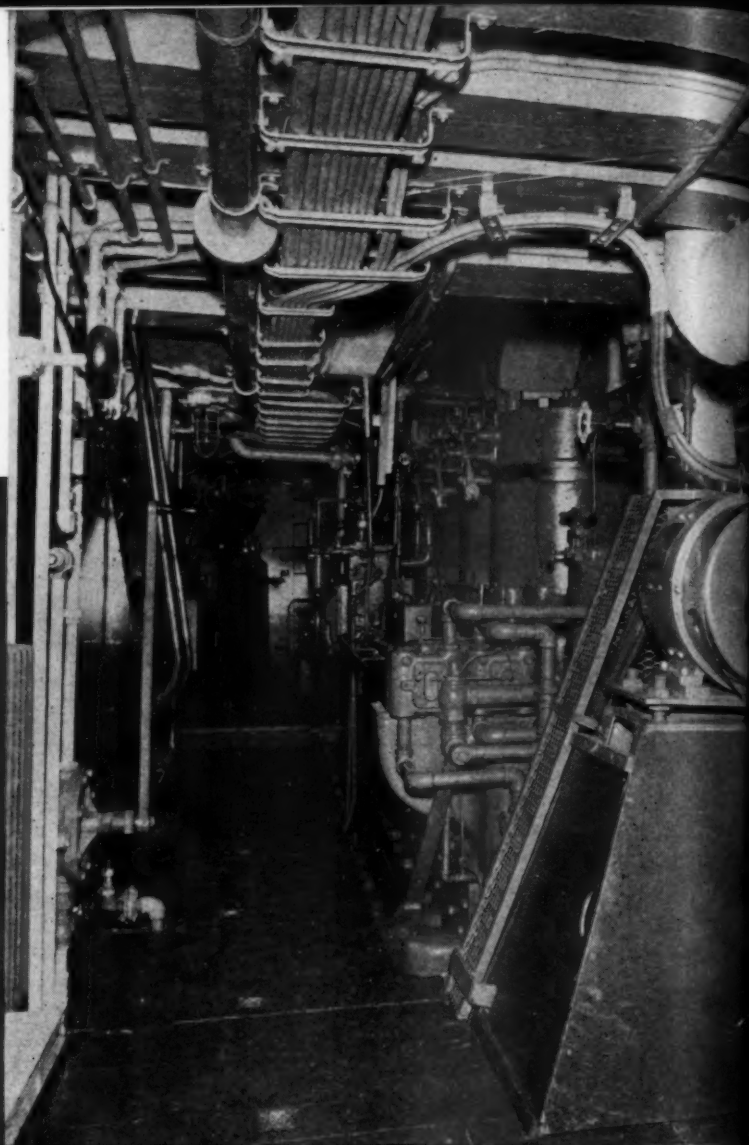


*Above: Peyton-built 96' Army Utility boat on trial run. Below: Wheelhouse view showing manual and air steering controls, telegraph and Weston bathometers.*

## FLOATING BRIDGES DIESEL DRIVEN



By  
JIM MEDFORD



*Control side of the Fairbanks-Morse, 450 hp. main Diesel and flywheel-driven battery charging generator.*

**B**EGINNING with the sensational raid on Pearl Harbor there has been a steady stream of Pacific Coast built barges, concrete barges and steel barges; wooden barges that really are floating warehouses; and barges for the movement of construction equipment and engineers' supplies. This story of the barges is one that has never been told. And we do not propose to tell it here.

These barges are mentioned only because they are the real floating bridges that mean so much for coastwise freight distribution while the deeper bottoms are off to the far corners of the earth with lend-lease and war material and Uncle Samuel's largesse for all and sundry. And how would a lowly barge get from one wet spot to another if there was lacking a stubborn, low-buttocked slogging tug on the lead end of the wire or manila hawser doing her

two or three knots to the tune of "ka-choo, ka-choo, ka-cha" of a heavy duty Diesel?

They come off the building ways, get dunked and go off on their trial spree with brass hats, shipyard higher-ups and civic dignitaries. Returning, they sidle up to their dock, get a good going-over by the fitters—checking everything for sure—then disappear into the haze. The record reads—"Destination unknown."

Careful comparison by trial and investigation decided O. A. Seigley, naval architect of the Army Engineers' office, to bring into existence the 96-foot seagoing tug which, with modifications, was adopted by Army Transport. Peyton Company's Southern California Newport Harbor yard got the contract for several with 450 hp. Fairbanks-Morse Diesels for main drive. The enterprising Peytons, because of over-

taxed yard space, built the first hull on leased land across the heavily traveled coast highway.

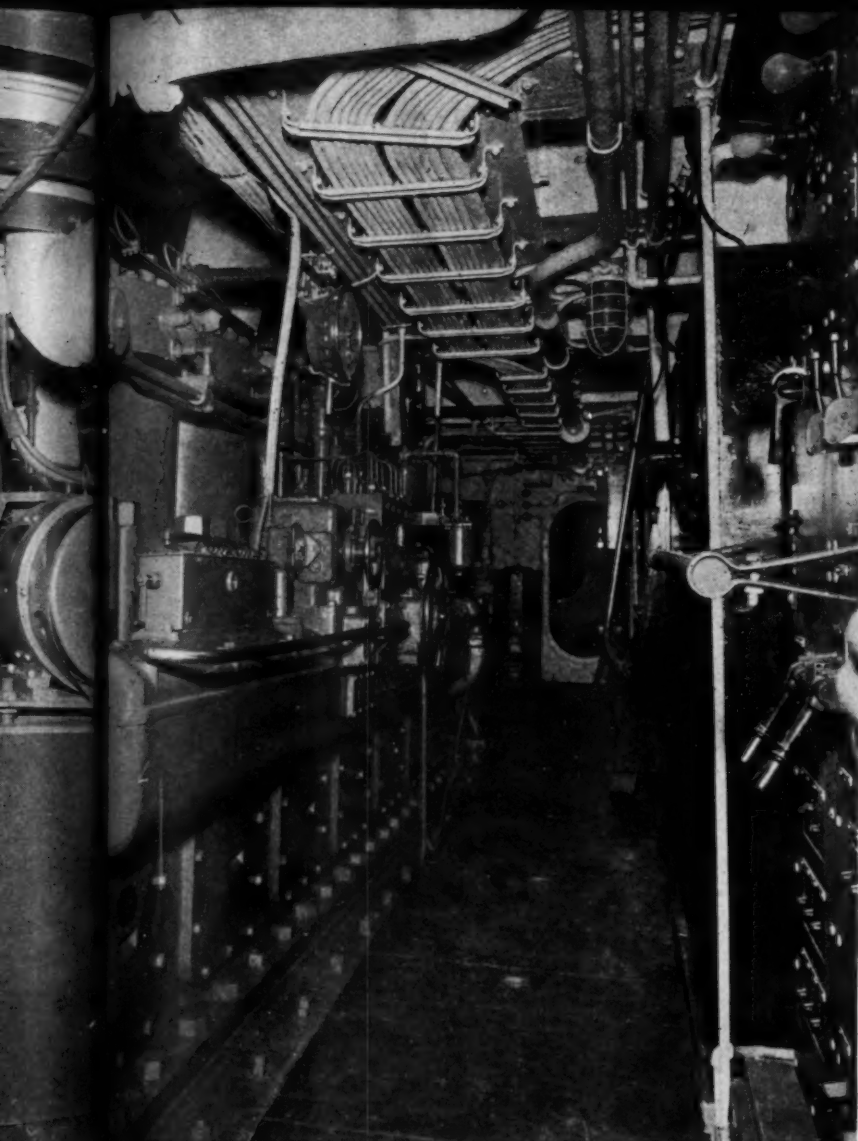
To get this 260 tons of towboat to the water-mark for fitting and launching meant a job of doing what no ordinary equipment could do. So, it meant "another" for Broughner Bucey of Long Beach, California. And, by the way, just to tie in the barge business a little closer, as we said at the beginning, Brough came over from skidding one of the largest barges into the briny—getting his hand in before the tug demanded his attention. Incidentally, this barge was 250 feet long, full 100 feet wide, weighed 1,450 tons and was launched sideways into a channel only 300 feet bank to bank. A "slew" in that narrow waterway would have spelled disaster.

With her 35-ton F-M Diesel on board and all

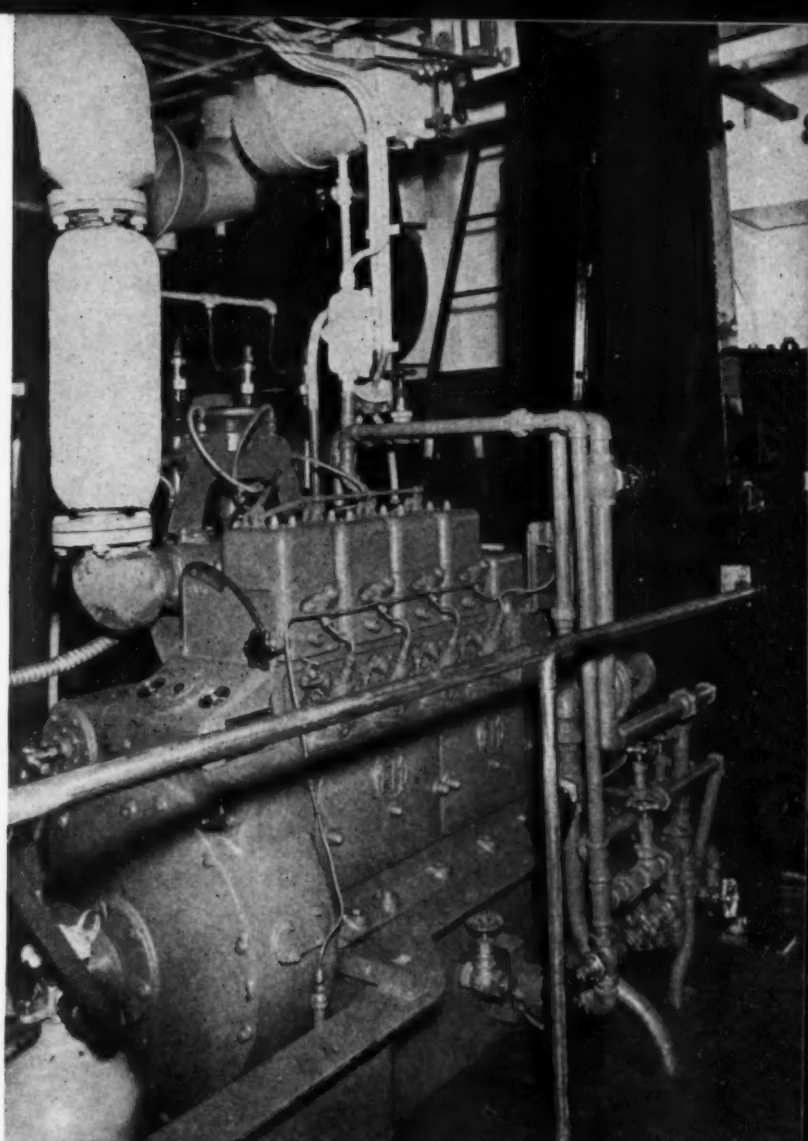
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Port side of main Diesel showing Purolator fuel filter on engine, Honan-Crane lube reclaiming, extreme rear, and watchboard, right.



Closeup of FM, 40 hp. auxiliary Diesel driving generator and fitted with power take-off for driving deck machinery.

set to go, the craft, 30 feet high and resting on 16 by 16-inch timbers with 14-foot eucalyptus shoes riding orangewood rollers over wooden tracks, creaked across the barricaded highway with the only casualty a snapped cable. At the flood of the six-foot tide she got her first taste of the salt Pacific.

Handy in size for either off-shore or coast-wise towing with an extreme beam of 26 feet and after draft of 10.5 feet, the TP-122 logged better than ten knots at 300 rpm., with the kind of maneuverability Skipper Bullwinkle of the *Salamander* wished he had the day he got in the way of Tugboat Annie's *Narcissus*, losing several feet of his port quarter rail. It is waterfront gossip that these babies can make a full circle turn in 80 seconds and from full ahead to a dead-water stop in nine seconds under a minute. That's what they say.

Single-engined, their main power plant is a 450 hp., two-cycle, six-cylinder, crankcase scavenging Fairbanks-Morse Diesel rated full power at 300 rpm. Fresh water cooled, the heat exchanger is kept at proper temperature with pumped sea water. Air tanks for starting are ten feet by 30 inches and four in number at 250 psi. Fuel capacity is 10,000 gallons, lube oil 250 gallons, and water 4,000 gallons.

The pilot house, built flush with the superstructure, affords a clear view fore and aft of either side of vessel from inside. Two telegraphs, a jingle and a gong provide full communication with engine room at all times. Staterooms are provided for crew, two men to each for a full crew of 16 men. The skipper and the two mates are berthed topside on the boat deck.

Complete refrigeration is provided and fire haz-

ard countered with carbon-dioxide installation including paint locker.

That is a picture of the clear-cut vision used in putting these 96-footers into commission. Because when sold after the present fracas, and they will be, they'll be ideal to build up our sadly depleted Coast fleet that went to war. They will set a standard and prove their application for those that come after. And, anyway, the plans, the molds and the experience that have gone into these gallant vessels will make quick work possible when they're through—over there.

Equipment includes: Pickering governor, Purolator and Honan-Crane filters, Burgess snubbers and Maxim exhaust silencers, Ross heat exchangers, Philco batteries, Weston and Westinghouse instruments, Crane valves.

Blade ends are checked to close tolerances after assembly in turbine wheels; tip speeds reach 600 mph.



## TURBOCHARGER ROTORS

### REQUIRE PRECISION

### WORKMANSHIP

By C. F. HARMS\*



This equipment detects imbalance caused by a patch of adhesive tape  $\frac{1}{4}$ " square. Rotors are checked for static and dynamic balance.

UNLIKE superchargers for aircraft engines, which have a comparatively short life expectancy, the turbocharger for a Diesel engine is expected to operate at high efficiency over long periods of service. The results of careful construction are best illustrated by a turbocharger of our manufacture which was recently dismantled, inspected and reassembled after 16,000 hours of service. It still showed no signs of deterioration, and estimates of its future service remain indefinite. In fact, no figures yet exist on the life of this type of turbochargers operating under normal conditions.

Such turbochargers are applied to 4-cycle Diesel engines in a wide range of types, ratings and applications. A turbocharger utilizes a part of the energy in the exhaust gas, which is otherwise wasted, to drive a centrifugal blower without demand on the power developed by the engine. This blower supplies all the air required by the engine cylinders, at a low pressure, through the conventional air intake manifold.

The low pressure air delivered by the turbocharger serves two purposes; it scavenges combustion space of the residual gas otherwise left at the end of the exhaust stroke, which it re-

\* Manager, Supercharger Department, Elliott Company, Jeannette, Pa.



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ROGRESS

places with cooler fresh air. Second, it supplies an air charge of greater density and pressure at the end of the suction stroke.

This provision for a greater amount of fresh air permits more complete combustion of a greater quantity of fuel. This in turn allows higher power output from a turbocharged engine than from an engine not so equipped. Moreover, scavenging the combustion space with fresh air cools the cylinder head and walls, the valves, and the piston, so that combustion of additional fuel may be accomplished without excessive heating of engine parts.

The rotor is, of course, the heart of any turbocharger, and its long life under operating conditions of high speed and high temperature depends upon fine materials, fine workmanship, and the utmost care in construction. Turbocharger rotors operate at from 12,500 to 21,000 rpm. and at temperatures up to 1020 degrees F. The tip speed of impeller and disc reaches 600 mph. The constituent parts of the turbocharger rotor are the blower impeller, turbine wheel, and shaft. Unusual construction care features the production of all three elements.

The blower impeller is a one-piece aluminum

casting, made by a special process and having a steel insert cast in the bore. A steel bushing is pressed into the impeller bore on one side of this insert which, with the bushing, is bored for a close fit on the shaft and keywayed for the four driving keys. A push fit seats the bore on the shaft. Close tolerances are required for outside diameters in order to seal the labyrinth rings affecting the discharged air pressure on both sides of the impeller, which is of the single inlet, highly efficient enclosed type.

For smooth operation each impeller receives a separate static balance and a separate dynamic balance. Balance test equipment is so exacting that unbalance produced by a piece of adhesive tape one-quarter inch square can be detected by weight and location.

Overspeeds ten per cent higher than name-plate rating speed limitations are applied to each impeller in a spinning pit, which is also used to test new alloys to destruction. Since stress rises as the square of the speed, a ten per cent overspeed gives a 21 per cent increase in stress, which is well beyond any safety factor requirement. The spinning pit tests are paced by an electrical tachometer, and speeds above 25,000 rpm. are attained by the application of com-

pressed air to the impeller edge through ports in the spinning pit walls.

Blower impellers are anodized to resist surface corrosion caused by salt water atmosphere. In addition to exacting visual inspection of the finished part, radiographs are taken of each impeller to detect hidden flaws. The serial number of each impeller is checked against the radiograph and transferred to record files.

Precision machining is also called for in the production of turbine wheels, which consist of slotted discs and inserted blades. The blades have bulbous roots, and are pressed into the rotor discs and peened. Made of highly complex dual austenitic-ferritic steel, which contains nickel and other alloys and is non-corrosive, blades and discs are designed for high tensile strength and low creep at high temperatures. Blades are fully machined, as is each slotted disc into which the blades are inserted. Turbine wheels and shafts are also given separate tests for static and dynamic balance.

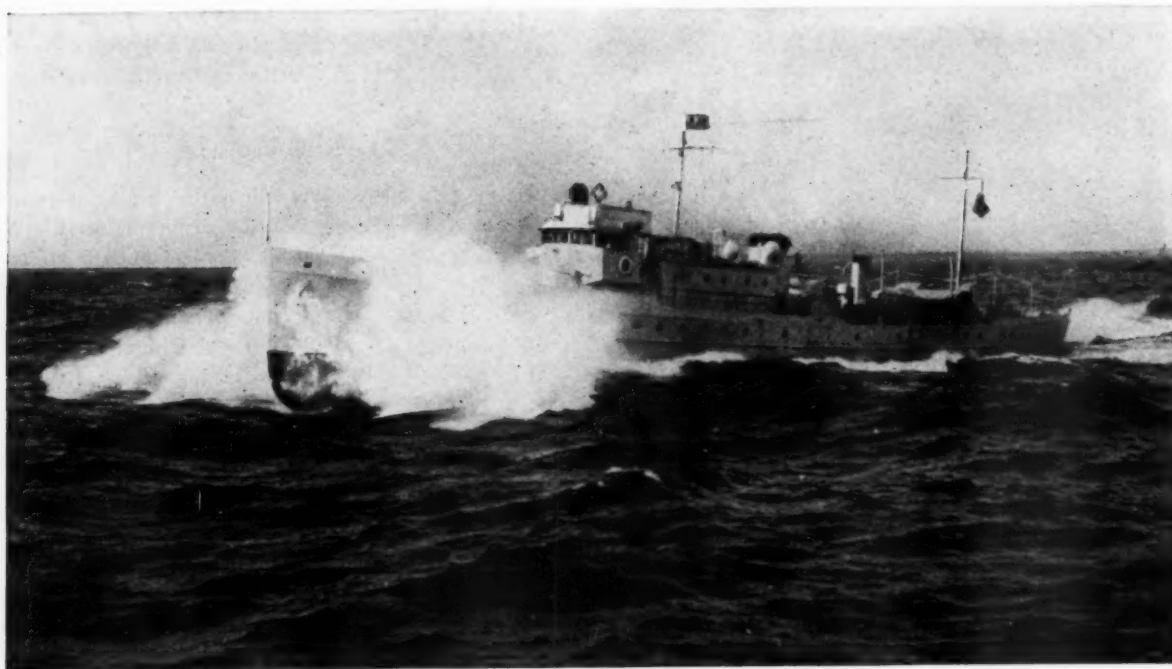
Both impeller and turbine wheel for an Elliott-Buchi turbocharger rotor are mounted on the same shaft, which is of chrome molybdenum alloy steel, heat treated to secure minimum creep and maximum dimensional stability. The turbine disc is doweled and securely bolted to the shaft by a special lock arrangement. An integral skirt on the shaft, adjacent to the turbine disc and overhanging the stationary bearing support, carries the impeller on a keyed fit held to the shaft by a special nut. This overhanging skirt serves to shield the bearings from the heat of the exhaust gases, and contributes materially to the long life of these units. The complete rotor assembly is then balanced both statically and dynamically.

Shaft journals are superfinished to provide frictionless shaft bearings. Cooling oil is introduced to the shaft through a duct in the center of the shaft, and is distributed by centrifugal force, plus pressure from an oil pump. The oil pump is driven by lugs on the special locking nut which secures the thrust bearing. A thrust collar of hardened and ground alloy steel at the outer end of the shaft takes the end thrust of the unbalanced part of the rotor.

As can be seen, a turbocharger rotor assembly requires exacting tests at every step, plus precision machining and careful construction. As speeds and temperatures increase with the development of gas turbines, to which turbochargers are closely related, even more exacting materials and workmanship—of a standard hitherto unknown in heavy industry—will be demanded.



*This double-walled spinning pit is used to apply 10% overspeeds to impellers. The inner chamber will accommodate impellers up to 17 in. diameter.*



## The trial run that launched a new steering system

**T**HE PHOTOGRAPH ABOVE was taken in 1932 during the trial runs of the Coast Guard Cutter THETIS.

The 165-foot THETIS was one of 18 such vessels equipped with the then new Sperry Electro-Mechanical Steering System. The 12-year record of the THETIS and her sister ships speaks for itself...

In peacetime, they served on general ocean patrol, Arctic and Alaskan patrol, and many special missions. When war came, these valiant little ships helped to form our first thin line of defense against the Nazi wolf-pack menace lurking along our shores, and gallantly held on until reinforcements were ready.

As a result of the performance of these equipments on the Coast Guard Cutters, the Navy chose the Sperry Electro-Mechanical Steering Systems for

installation on 200 of the first Patrol Vessels which were authorized shortly before Pearl Harbor. Thus, when the emergency arose, this steering device also was tried and proved—ready to go to war. Since 1941, more than 2,000 installations have been made.

Normally, "finger-tip" electric steering is provided. If power should fail, a clutch in the steering stand permits the wheelsman to shift control immediately to manual steering. A rudder indicator shows rudder position in both hand and electrical steering. One or more non-follow-up steering controllers may be located at any place on the ship.

Electro-Mechanical Steering Systems are in use on many craft of the Navy, Coast Guard, Merchant Marine, and Army, and on privately operated tugs, ferryboats, and other craft.



The Sperry Electro-Mechanical Steering System is economical, rugged, and dependable. In the case of 32 installations where careful records were kept, maintenance costs for this equipment averaged only eight dollars per year.

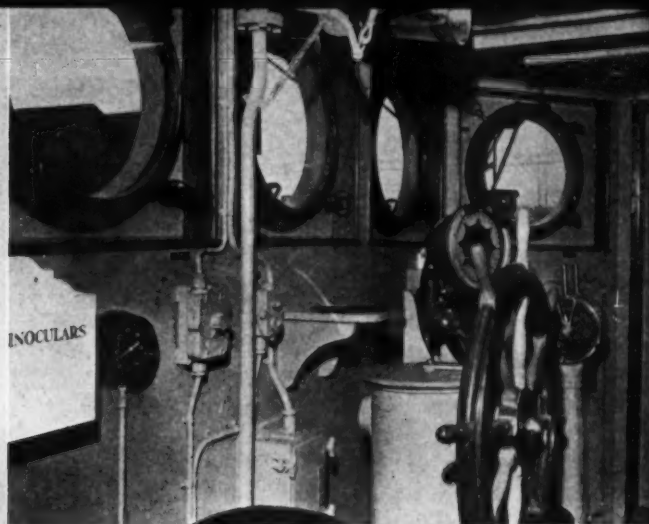
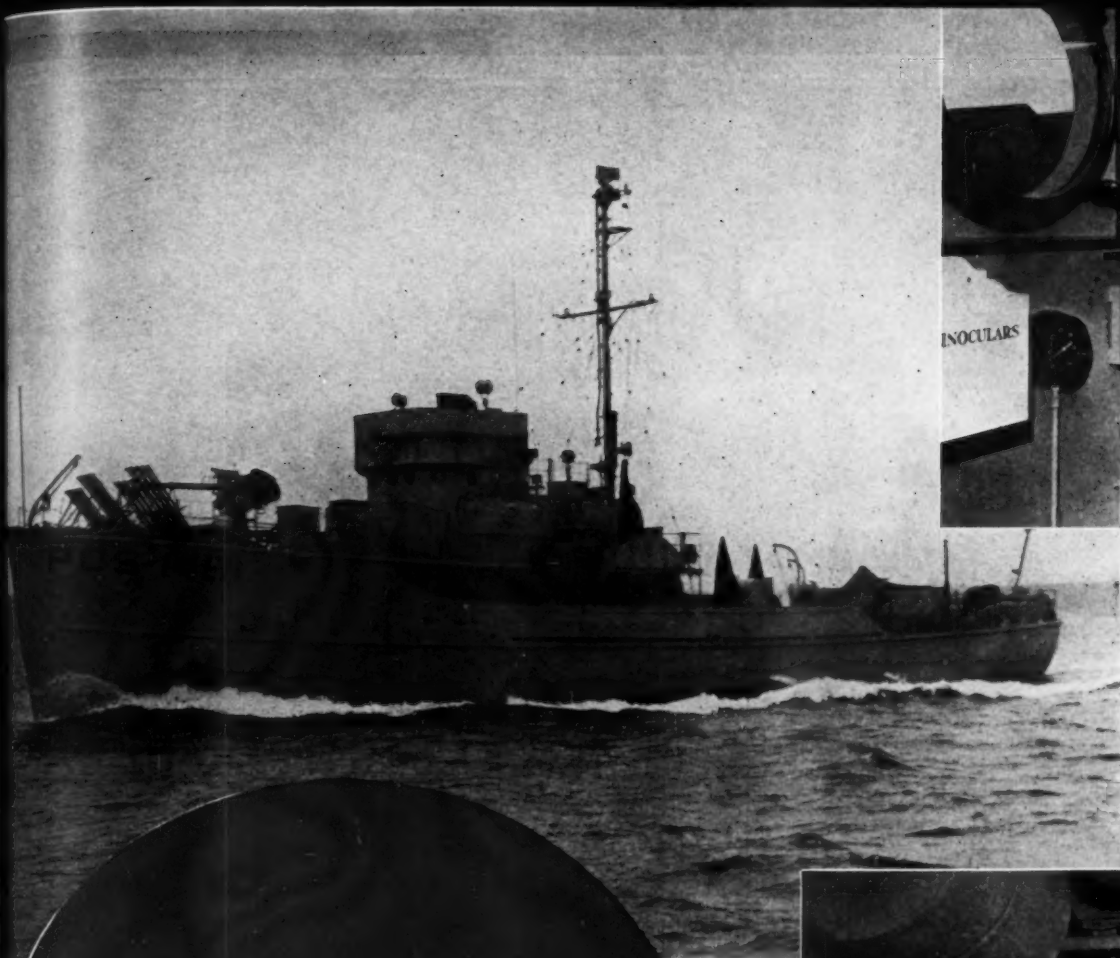
## Sperry Gyroscope Company

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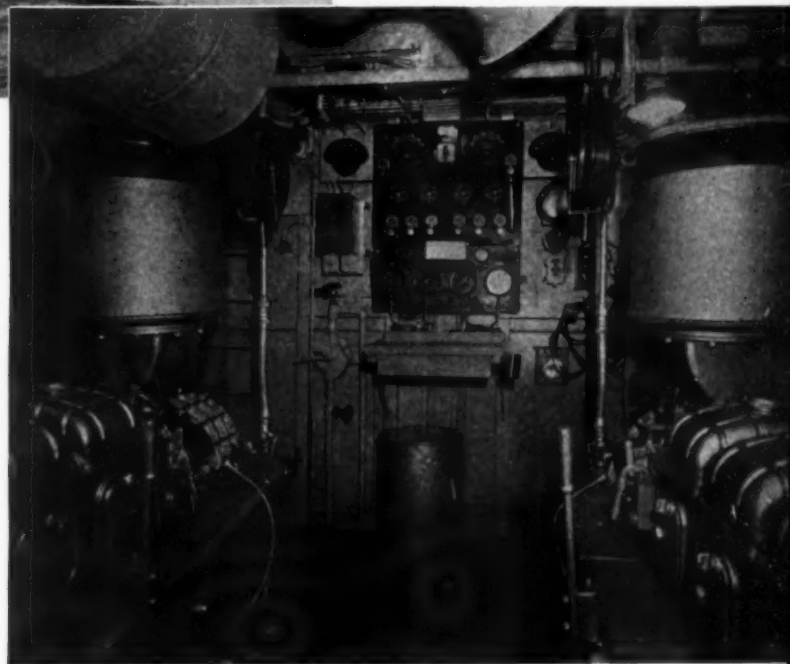
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*Left: PCS 1451 on trial run in Tacoma Harbor; she was built by Tacoma Boatbuilding Co., Tacoma, Washington. Above: Pilot house view.*

*Below: View of the control station between port and starboard main General Motors Diesels. Note Burgess intake snubbers, left and right center, and four Weston tachometers across top of instrument panel.*



## MACHINERY DETAILS OF PCS TYPE NAVAL AUXILIARY

By CHAS. F. A. MANN

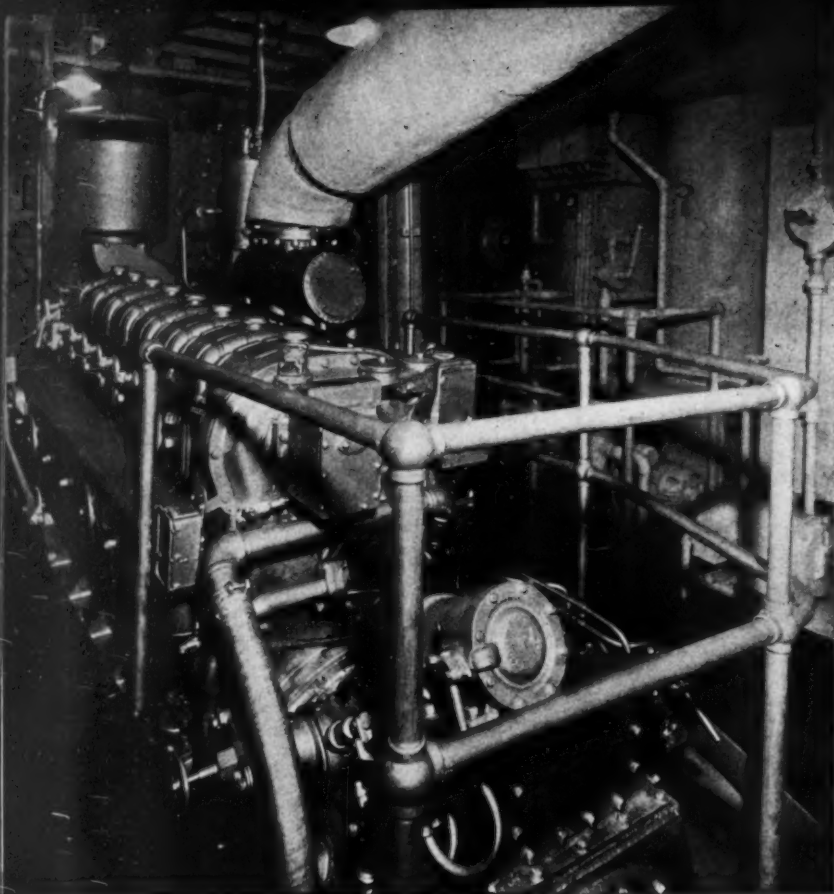
**L**AST year DIESEL PROGRESS was the first to publish details of the YMS Navy Auxiliary craft, some 450 of which have been built in various yards on both coasts. Now we are able to publish machinery details of the PCS type, a somewhat less complicated special craft for Navy duty, although almost identical to the YMS type of craft in design and arrangement of her machinery.

Various Pacific Coast boatyards received contracts for this neat little Diesel craft, among them being two allotted to Tacoma Boatbuilding Company, noted YMS contractor who have

already delivered a dozen of these vessels and will have finished their PCS boats before this story is published. The PCS type is far simpler in special equipment, and was designed for a type of patrol duty dissimilar from the YMS type. The principal items of interest for our readers are simply in the range of mechanical equipment, rather than minute technicalities about strictly Naval equipment and specialties—basically the Marine-Diesel phase that goes to make up a definite ship type needed in the war effort. So we study the PCS 1451—one of the 95 of this interesting new Diesel craft, alike as 2 peas in a pod.

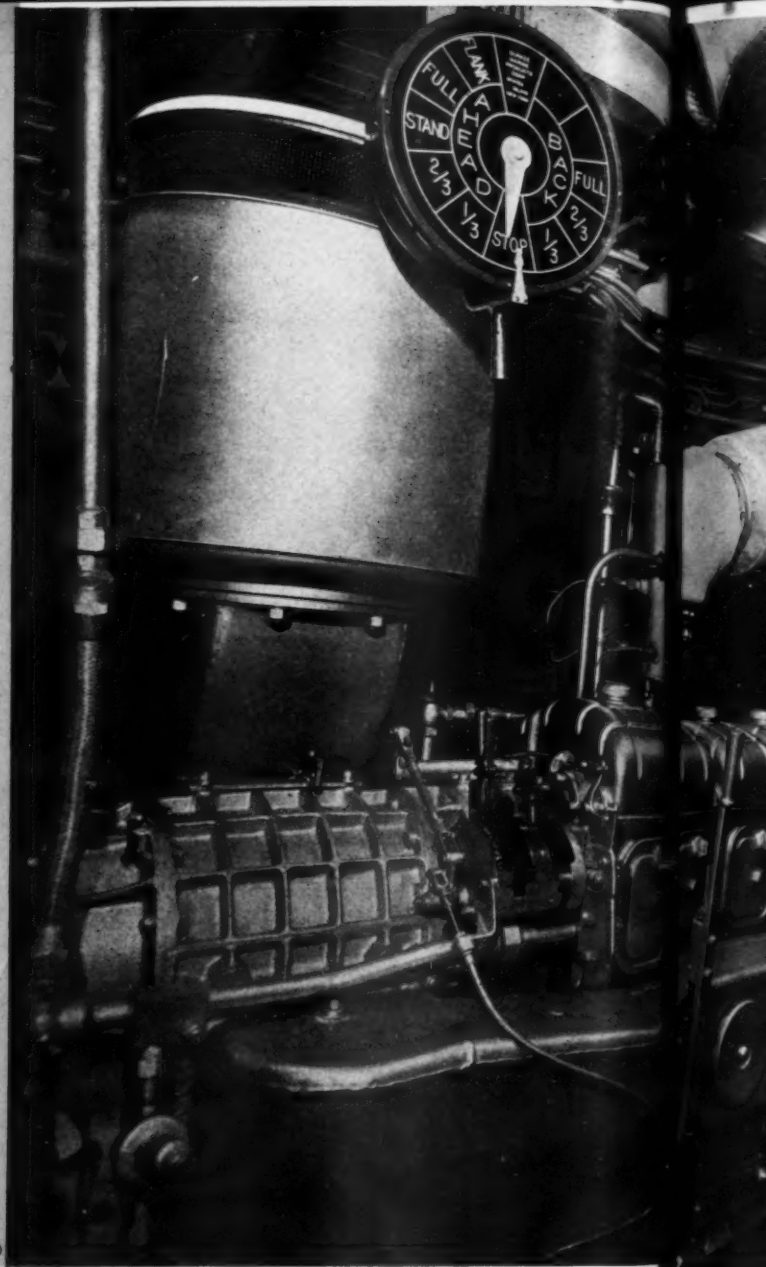
Having the identical hull dimensions of the YMS—136 x 24.6 x 12 ft. depth and a tonnage of 267, the PCS is subdivided into 11 watertight compartments and has bent oak framing with heavy Douglas fir planking, and upper structures of waterproof Douglas fir plywood on fir framing. They embody the very high standard of construction this famous Northwest boatyard is noted for.

The interior layout is adapted to a lightweight high speed power plant occupying most of the lower hull, together with storage spaces, and a very large 3-compartment crews quarters for



↑ The starboard main engine, a GM 500 hp., 2-cycle Diesel.

→ Quartering forward view of the port main engine.



55 men—somewhat larger crews quarters than the YMS type. Deckhouse space on two levels, accommodates a group of 4 officers, galley, two messrooms, lavatories and the funny little pilot house atop, with still another open-air pilot house behind the novel Venturi Windscreen, atop the enclosed pilot house. Basically the entire ship is built like a yacht, with raised deck forward, transom stern and a single mast.

The main propulsion plant consists of a pair of 8 cylinder General Motors, 2 cycle Diesel engines, rated 500 hp. at 1270 rpm. Each operates through a reduction gear and drives a Coolidge bronze propeller, on Micarta stern bearings. The Diesels are fully enclosed, have Harrison heat exchangers for lube and the closed fresh water cooling circuits, Burgess air intake filter-snubbers and Weston tachometers, and are controlled from a single stand in the engine room. Briggs oil clarifiers are fitted also a Taco oil fired hot water heating boiler.

Primary auxiliary power is furnished by a pair of 2-cycle General Motors Diesels, one a 3 cylinder 30 kw. unit and the other a 6 cylinder 60 kw. set, both fully automatic and both with almost identical auxiliary equipment and arrangement as that of the main engines. Current is produced at 120 volts d.c. thus eliminating any storage battery sets.

A 750 gallon per day Kleinschmidt fresh water distiller is fitted, made by the E. B. Badger & Sons Co., with elaborate tank and pump and control layout. Most all main electric circuits are controlled by Cutler Hammer fully enclosed switch units. Burgess spark arrester exhaust snubbers, (wet type) are fitted to both the main and auxiliary Diesel units. Main control switchboard is a Royal unit, and a Walter Kidde CO2 fixed and portable fire control system is fitted.

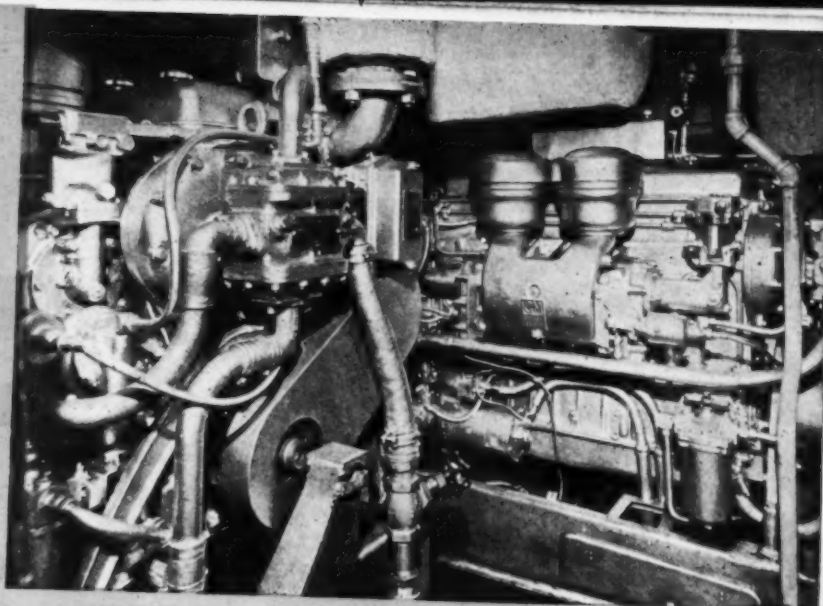
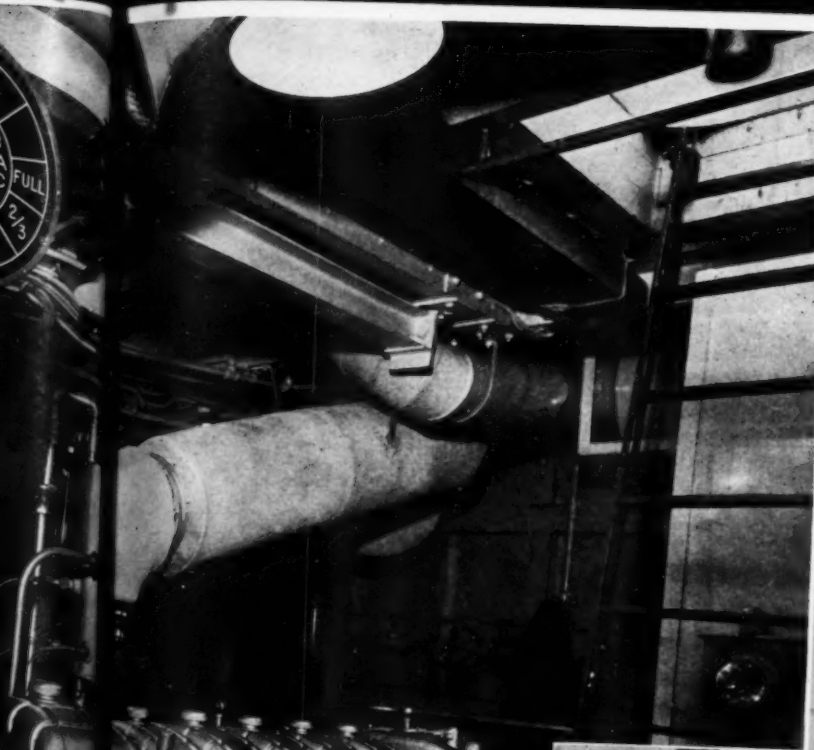
Hand steering is employed, using a bronze rudder. A Sperry gyrocompass is used, as well

as a Gardner Denver air compressor and a large York ice machine, both motor driven.

An Arms Franklin electric anchor windlass is fitted on the forward deck; Ilg heating and ventilating fans are used in the quarters; Blackmer oil transfer pump; Ingersoll Rand booster pumps on the auxiliary generator; Joshua Hendy salt and fresh water sanitary pump systems and Blackmer lube oil hand pumps. All these are interesting items of high-quality equipment necessary to make the ship perform. While the strictly Navy equipment and the details of usage of these craft are of fascinating interest to all marine and equipment-minded people, the usual restrictions on this kind of detail in wartime must be observed.

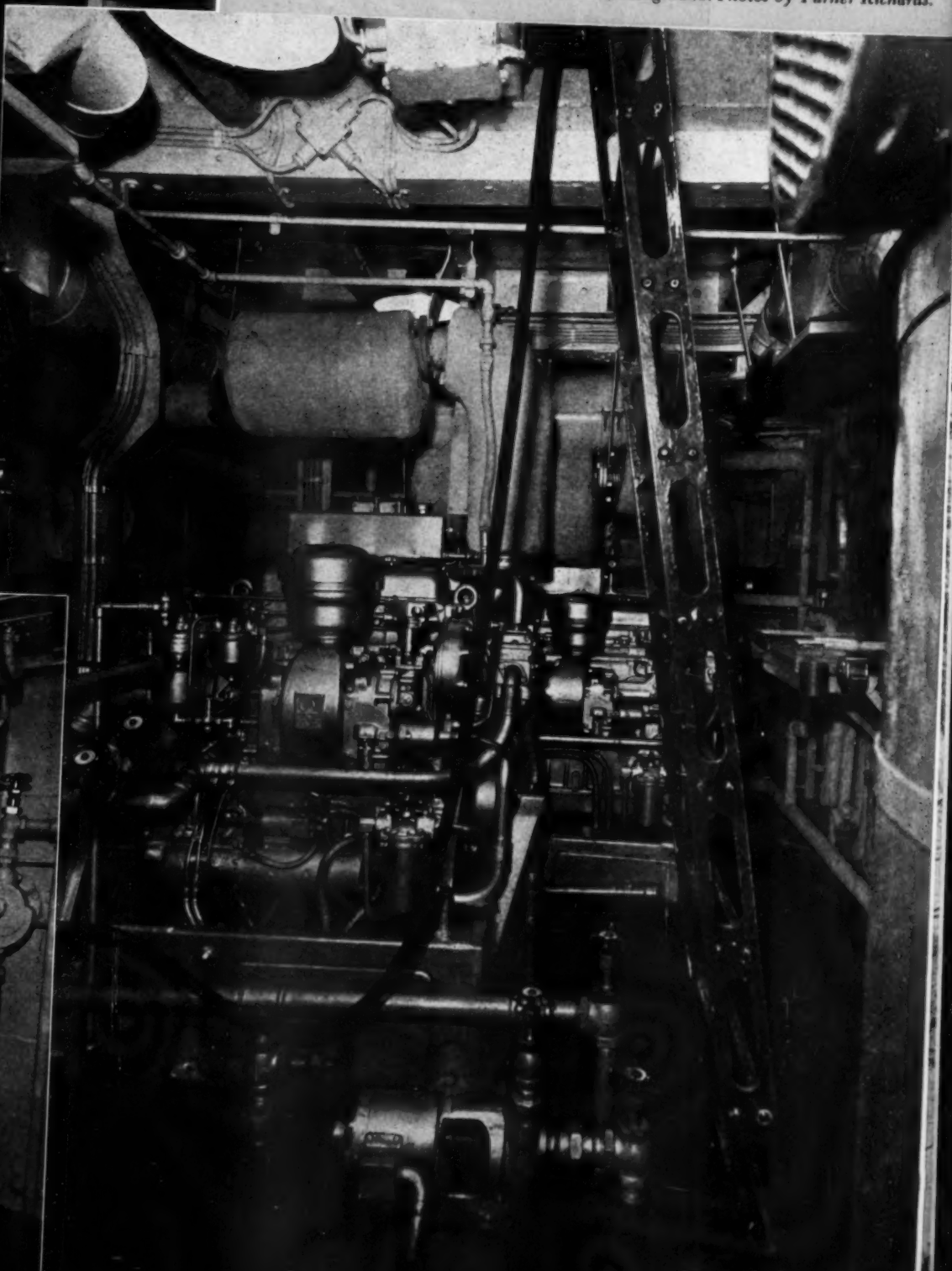
The main point is that these ships represent the highest class of mechanical and Naval architectural planning and they are a credit to United States naval fleets.





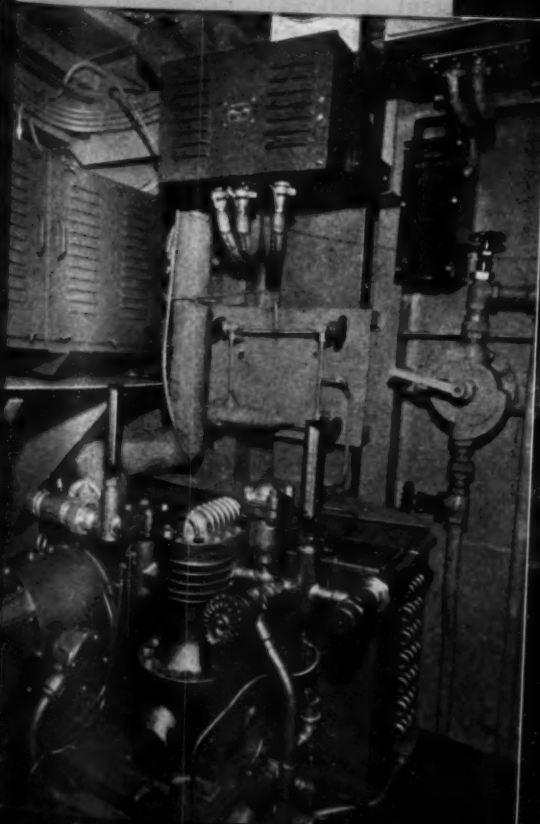
Closeup of the two General Motors Diesel generating units.

The 30 kw. unit, foreground and the 60 kw. unit, background. Photos by Turner Richards.



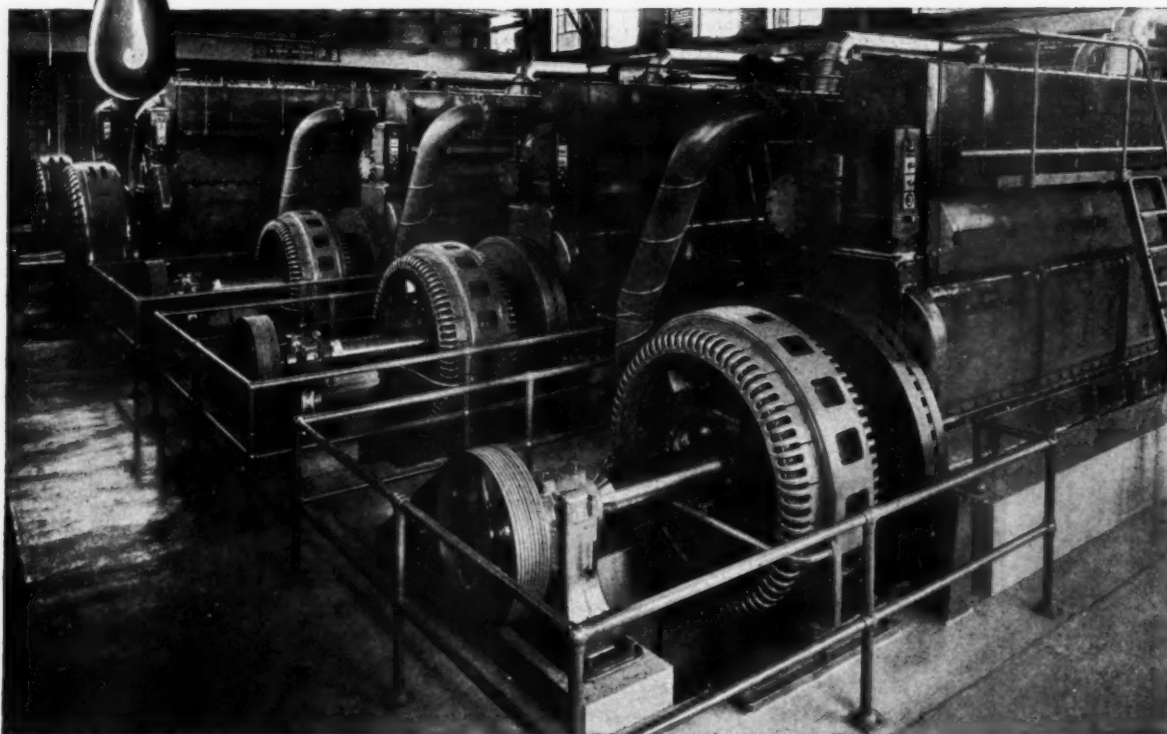
View of the York refrigeration equipment.

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**SOLUTION** — *Correct lubrication.*

For *correct* lubrication of Diesels, Sinclair provides both RUBILENE and GASCON OILS to meet the different requirements of various types of engines.

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(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

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# SUPERVISING & OPERATING ENGINEERS' SECTION

## SOME ESSENTIAL CHARACTERISTICS OF POWER PLANT PERSONNEL

Conducted by R. L. GREGORY\*

**T**HERE is a great deal more to the operation of any power plant than the mere turning out of so many kilowatts a day, the pumping of so many gallons of water or the maintenance of so many street lamps for the convenience of the community. The average layman does not know all the ins and outs of the intricate system which daily supplies his wants and needs for these essentials at any hour of the day or night.

Efficient service means efficient operation and efficient operation must be backed by efficient operators and maintenance crews. We have all been asked at some time or other, what we deemed essential characteristics in an efficient operator or an efficient maintenance man. When this question was propounded to a nationally known superintendent of a large utility some years ago, his answer immediately was "Thirty per cent experience and seventy per cent good horse sense."

On the face of the remark it would appear to be rather abrupt and out of line, but at the same time it thoroughly covered the matter. In these days of manpower shortage many a power plant supervisor has been hard pressed to keep an efficient and well balanced operating and maintenance organization. He has had to use men with little or no experience, and has put in long tedious hours of breaking in help to handle his equipment. But just what are the essential characteristics of a good operator or maintenance man?

Experience, of course, is to be desired, but often the securing of experienced help is out of the question. One of the most desired characteristics of a good operator is alertness. An alert operator or a man learning to become an operator with this characteristic will always be on the lookout for things which do not seem proper to him. If he notices some condition foreign to his experience and which he does not understand he will ask about it, and seek to improve his knowledge. Many an operator who has been wide awake, interested in his job and the care of his equipment has discovered some condition which if allowed to continue would result in an outage or breakdown. Supervisors cannot

be expected to notice all the little details of operation, and while most of them do make periodical rounds examining equipment, noting operating conditions, etc., oftentimes they may overlook some item, or some condition may arise between rounds which should be given attention.

Another characteristic essential is good judgment. A good operator or maintenance man should have self confidence in his ability to do the right thing at the right time. Power plants have a habit of springing the unlooked for situation at the unlooked for moment, and the timid soul who lacks judgment is a poor asset in such a condition. Suppose your units are operating along normally when suddenly you discover a foreign and peculiar sound in one of your engines. The efficient operator immediately investigates and reports his findings or if help is not immediately available, exercises his judgment to the best of his ability and corrects the trouble. It may mean putting on another unit, and the shutting down of the one giving trouble. But he goes about it in a business like manner and doesn't get panicky and run for the wide open spaces.

Another very desirable characteristic is cooperation. There are enough problems in the daily operation of any plant without forcing others upon those in charge. One uncooperative employee can cause more damage than the balance of the personnel can correct in many hours. The operator or maintenance man who assumes the attitude that the boss is hired to look after the units and lets little conditions of which he is cognizant go without reporting is another very poor asset, especially in times like these. We have often heard the remark "Ah that doesn't concern me, that is John's job, or I'm not paid to do that, Bill is supposed to look after that equipment." Perhaps John or Bill are up to their necks in some other trouble and a little cooperation on this man's part will mean a lot in the efficient operation of the plant, or the care of the equipment. No plant can be successfully operated without whole-hearted cooperation. Petty grievances and jealousies should be left at the gate, as the good operator and maintenance man have no place in their hearts for such trifles, when all out production is at stake, or at any other time.

Inquisitiveness is another laudable characteristic. The man who is interested in his equipment and in his job is inquisitive. He wants to know the why and the wherefore of things, how they should operate. Of course such inquisitiveness must be directed. Curiosity can also be detrimental if practiced upon equipment which is not understood.

Punctuality is also a desired characteristic. The man who is punctual at his work, in his duties of operating and maintenance, is likely to have a much easier time on his job than the laggard who has to be continually prodded along to get his tasks done. Punctual rounds of inspection, punctual taking of readings and oiling all go for better and more efficient operation.

Supervisors should develop the habit of listening to suggestions from the personnel. The old adage that two heads are better than one still holds good and many a novice in the power plant game has come through with a suggestion that would improve plant efficiency. The know-it-all supervisor who is unwilling to listen to suggestions is just as bad off as the operator or maintenance man who is unwilling to cooperate with his fellow workmen. Listening does not entail the carrying out of those suggestions. A supervisor must exercise his own judgment as to the merit of the suggestions.

Another very desirable characteristic is the ability to admit a mistake. No man is infallible and mistakes of judgment or errors will occur. If all try and when a member of the plant personnel does make a mistake, his error should be admitted and the buck not passed on to some other innocent fellow workman. One of the means of development in any enterprise is the profiting from the making of mistakes, not repeating a mistake a second time.

Mechanical ability is another important characteristic. When possible, natural mechanical ability should be encouraged. Oftentimes operators and maintenance men conceive ideas or methods to shorten certain operations and thus save time and labor. Such characteristics when found should be encouraged and not turned down. Many a good man has been lost because his ideas and self expression have been squelched too often.

\* Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.





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*A Part is never made right  
unless it is  
satisfactory to our customers.*

★



## A War Department Release

**D**IESEL engines played a big part in the building of the Alaska Highway. Now that the road has been largely completed, hundreds of Diesel trucks still roll over the Highway in the operation of this huge 1523-mile project which stretches from Dawson Creek, British Columbia, Canada, to Fairbanks, Alaska.

Under the direction of Colonel J. P. Glandon, commanding officer of operations on the Alaska Highway, these trucks are driven by hundreds of United States Army soldiers of the Quartermaster Corps. A special roster of Diesel truck drivers is kept at the relay stations located every 200 miles on the road, and these men are used exclusively for their operation.

When one of these big 10-ton cargo trucks rolls into a relay station, it is immediately inspected in a second echelon garage, and is serviced with fuel and lubricants. Then before the engine has a chance to cool, another driver is assigned to the vehicle and cargo, and he is immediately dispatched to the next station up the road. Night and day these big Diesel trucks roll over the Alaska Highway. Neither temperatures of 60 degrees below zero, ice and snow, nor the mud of the sub-Arctic spring thaw can stop them to any appreciable degree.

Diesel trucks have moved thousands and thousands of tons of freight over the Alaska Highway in the building and operations of the Highway itself, the Alaska telephone line, the Canol oil development project, and other projects in the far Northwest under the supervision of the Northwest Service Command of the United States Army. The Northwest Service Command, with headquarters at Whitehorse, Yukon Territory, Canada, has been under the supervision of Brigadier General James A. O'Connor since September, 1942, with Colonel K. B. Bush as his Chief of Staff and Colonel C. R. Hazeltine as Deputy Chief of Staff.

Use of Diesels on the projects was highly diversified, inasmuch as the country through which the projects extended was wholly undeveloped before the Army entered. There were no power lines onto which the soldiers could hook, no

water systems, no laundries, and none of the other conveniences and utilities which are ordinarily taken for granted. Along the Alaska Highway from Dawson Creek to Fairbanks, there was only one town, Whitehorse, in Yukon Territory, Canada, which could with any degree of correctness be called a town, or a source of any of the utilities needed. In addition to the actual construction of the highways, telephone lines, and oil lines, complete and self-sufficient camps had to be built and maintained to house the soldiers and workers engaged in these projects.

Diesel engines were used for power in running generating plants to furnish electricity for temporary camps, and to provide light for night construction. Besides the three main terminals of the Alaska Highway, at Dawson Creek, Whitehorse, and Fairbanks, there is an Army way or relay station every 100 miles up the road. These stations consist of second echelon garages, inspection sheds, dispatchers' offices, mess halls and barracks. Power for these stations is supplied in the main by Diesel generators.

The only laundries equipped to handle large volumes were in Edmonton, Alberta, and Fairbanks, with none on the 2000 miles of roadways between. So the Army, using Diesels for power, constructed several laundries of their own. In many cases and especially in Alaska, the constructors had to supply their own lumber, and this was obtained by using Diesel-driven portable saw-mills. During the construction season of 1943, there were about 7000 pieces of rolling equipment employed on the project. This, of course, necessitated repair shops. Line shaft drives powered by Diesel engines were used in all cases.

The gravel-top finish of the Alaska Highway required crushing, screening, and washing plants for gravel operation. These were scattered along the entire length of the Highway, and the majority of them were Diesel engined. Camps had to be furnished with adequate water supply. Pumps powered by Diesel engines were used in most cases. Hundreds of tractors, bulldozers, shovels, and large cargo trucks were powered by



Diesel engines. Diesel engines were used in tractor units for low-bed trailers.

The biggest problem in Diesel operation was encountered in the sub-zero weather of winter. The Diesel fuel used had a pour-point of zero degree F. At temperatures below that figure the fuel at first became cloudy and at extreme temperatures solidified to such an extent that it ceased to flow. The cloudiness was caused by the formation of wax, and this quickly clogged screens and fuel lines causing considerable trouble. Lubricants also were not suited for sub-zero weather.



# ALASKA HIGHWAY

Top view: Pvt. Robert R. Johns of Mansfield, Missouri, (left), and Pfc. D. J. Korzatkowski, Albany, N. Y., check their loaded Diesel truck at the Dawson Creek Relay Station before starting up the Alaska Highway. Below: One of the many Diesel trucks that roll on the Alaska Highway.



Many field expedients, none very satisfactory, were used to offset this condition. Fuel lines and tanks were thawed by means of blow torches, oil pots, or gasoline fires, all of which were dangerous practices. Sometimes lines were run from the engine to the fuel tanks and in other cases hoods and tarps were used to keep the liquid from congealing.

It is believed that fuel difficulties will be largely eliminated this winter by the use of a new Diesel fuel suitable for use in 50 or 60 degrees below zero weather. Satisfactory lubricants are now available for cold weather operation. Under as severe winter conditions as could be found anywhere, Diesel equipment on the Alaska Highway has performed highly satisfactorily.



## TEN-STRIKE IN POWER



A *ten-strike* is defined as "any successful and decisive stroke or act." That's why we call the modern, high speed Cummins Dependable Diesel a "ten-strike in power." For in every heavy-duty service—automotive, industrial and marine—Cummins' development of the high speed diesel (beginning in 1918) has proved to be a successful and decisive factor in reducing power costs to a new low . . . raising profits to a new high! CUMMINS ENGINE COMPANY, INC., Columbus, Ind.

**CUMMINS**  
*Dependable*  
**DIESELS**

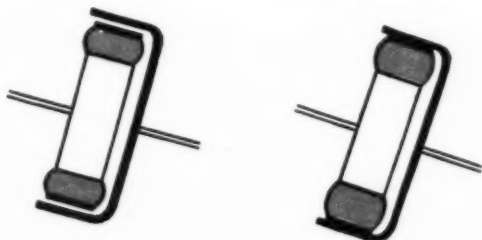
SINCE 1918...PIONEER OF PROFITABLE POWER  
THROUGH HIGH SPEED DIESELS



**HEAVY-DUTY MODELS FOR AUTOMOTIVE, INDUSTRIAL, AND MARINE SERVICE**



# A Heavy Duty Clutch can be Simple-Positive-Trouble-free



## See how it works

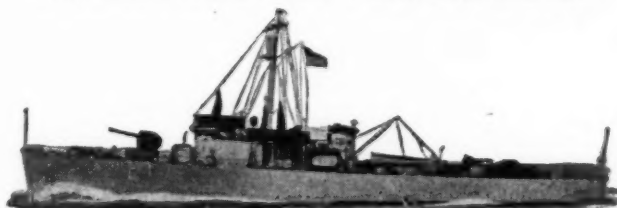
This is a new type of heavy duty clutch. It controls power by air pressure. It is a new—but thoroughly proved—way to transmit power from its source to the machine that does the work.

At the left you see a diagram showing the clutch disengaged. A rubber and fabric air gland, on the drive member, rolls free of the driven member.

At the right, you see the gland inflated. It expands against the driven member, to effect a clutch action that can be as light, or as firm, as you want it. Deflate the gland and the clutch is disengaged.

That's the principle of the Fawick Airflex Clutch— as simple as that! It requires no levers, arms, toggles or springs—no lubrication. No adjustment—low maintenance—long service.

## Here is PROOF OF PERFORMANCE



Many hundreds of Vessels in The Navy and Merchant Marine are equipped with the Fawick Clutch.

For descriptive book write to

**FAWICK AIRFLEX COMPANY, INC.**  
9919 Clinton Rd. Cleveland 11, Ohio

In Canada, Renold-Coventry Ltd., 1006 Mountain St.,  
Montreal, Canada

In Britain, Crofts Engineers, Ltd., Bradford, England



## Here is the CLUTCH that brings you these 12 Advantages

1. Simple in design and operation
2. Flexible control by air
3. No adjustments or oiling—low maintenance
4. Dampens vibration—absorbs shocks
5. Corrects misalignment automatically
6. Smooth starting—no jerks
7. Runs cooler—uniform pressure
8. Controls torque by air pressure
9. Greater capacity—more compact
10. Remote control by air valve
11. Replaces flexible couplings
12. Acts as clutch, slip-clutch, brake and coupling.

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Heavy Machinery Drives  
Paper Mill Drives  
Drops and Cranes  
Mine Hoists  
Diesel Drives  
Rubber Mill Drives

# FAWICK *Airflex* CLUTCH

POWER CONTROLLED BY AIR

# Exchange Your Diesel Maintenance Ideas

## "Checking Shaft Alignment with a Strain Gage"

Conducted by R. L. GREGORY

*Editor's Note: In this department we provide a meeting place where Diesel and Gas engine operators may exchange mutually helpful maintenance experiences to keep our engines in top condition. Mr. Gregory edits your material and adds constructive suggestions from his own wide experience. This is your department—mail your contributions direct to DIESEL PROGRESS.*

**T**HIS department is in receipt of a letter from Mr. K. C. Finch, Superintendent of the Municipal Water and Light Plant of Jetmore, Kansas, which we quote as follows:

"I have just read your very interesting article in the May issue of DIESEL PROGRESS, entitled, 'Test instruments necessary to good plant maintenance.' Of particular interest to the writer was the part regarding maintenance of crankshaft alignment by use of the strain or deflection gage method. I have never completely understood the proper checking of crankshaft alignment by this method and would appreciate very much if you would advise me exactly how this is done.

"Also please advise me as to the amount of distortion which you would consider safe in the crankshaft of Diesel engines, as determined by the above gage method, when taken at the four quarter positions."

Since it is possible that other engineers are not thoroughly familiar with this sort of check, perhaps an explanation of this method can be given from a letter received from Mr. Gus Berglund an experienced Diesel inspector who has also written this department giving his use of the method in checking shaft alignment. Mr. Berglund's letter is as follows:

"I have used the strain or deflection gage method for years in checking crankshaft alignment, and it is the standard method with our company. In using the strain gage method, the gage is placed between corresponding webs on the shaft, well toward the outer edge. A deep punch mark is placed in each web, these marks being directly opposite each other on the inner faces of the web, and equidistant from the shaft. Two strain gage extension rods are used, the gage being placed in the middle, with an end of each rod firmly placed in a punch mark hole, the strain gage then being parallel to the shaft between the inner faces of the webs.

"In placing the gage in position care must be exercised to see that sufficient tension is given to each rod to hold the gage firmly in place and also allow the hand to swing from the plus to minus position freely. After placing the gage in position and securing the desired tension, revolve the gage several times to see that it remains in position. Place the dial in such a manner that the hand points to the zero mark when the webs are in as near top center position as the connecting rod will allow.

"With this top center position as a starting point and the reading zero, turn the crank forward one quarter of a turn and take the forward quarter reading. Continuing in the same direction turn the crank to the bottom quarter and secure that reading. Then rotate the shaft until the back center quarter is reached and again read the gage. At each point of reading the gage should be turned over several times to assure you of a correct reading. When all four readings have been secured reverse the rotation of the crank and check your readings in all four positions until you finally reach top center, when you should again secure a zero reading providing your gage had remained in proper position between the center punch marks.

"A comparison of the readings will indicate whether or not your shaft is out of alignment either sideways or up and down, and any deflection of any more than allowable distortion should be corrected to relieve undue stress and strain on the shaft and webs. If checking the alignment of a driven object such as a generator or any other equipment handled by a shaft extension such as in boat propulsion or similar drives, these readings must always be taken at the web nearest the driven object."

The writer regrets that he has not available at present, pictures showing a test of this nature being made, but will endeavor to have such illustrations shown in the next issue of DIESEL PROGRESS. However I might give a more concrete illustration following the same method given by Mr. Berglund.

Suppose that you were checking the alignment of a generator extension shaft which extends say fifteen feet from the center of the webs next to the extension shaft to the center of the

outboard pedestal. When the gage is set in proper position with the proper amount of tension on the rods you take your top center reading as zero, where the hand on the gage has been placed, this position used as a starting point.

Revolving the crank to the forward quarter you again take a reading and find that you still have a reading of .000" or zero. Continuing in the same direction you revolve the shaft to the bottom center position and there you find you have a reading of .005" minus. Then continue to rotate the crank in the same direction to the back quarter position and you find that you again have a reading of .000" or zero. Reverse the shaft rotation and check each quarter until you arrive at top center position. This will check your readings. Since you have readings of .000" at both forward and back quarters, there is no misalignment of the shaft sideways. But you do have a reading of .005" minus when the webs are in bottom center position. This shows that when the webs are in this position they are distorted toward each other to the amount of .005", which means that the outboard bearing is too low and must be shimmed up to do away with web and crank distortion at this position.

In such a case a shim of approximately .075" placed under the outboard pedestal will greatly relieve this strain and after operating the unit for a couple of weeks the alignment could again be checked as before to ascertain the results. However this should relieve the tension at the webs and on the crank for all practical purposes.

Mr. Finch asked just how much distortion would be considered safe. This would vary with different size units and different speeds. However to be safe I would under any conditions secure as little distortion as it were physically possible to obtain. Shaft distortion is always bad and on larger slow speed units engineers consider that .010" is maximum under all conditions. The same method can be used in checking alignment between individual bearings, but when taken here, one should start at one end of the unit and check each individual set of webs until he has covered the entire unit. Then a comparison of these readings will disclose any misalignment or low individual bearings.





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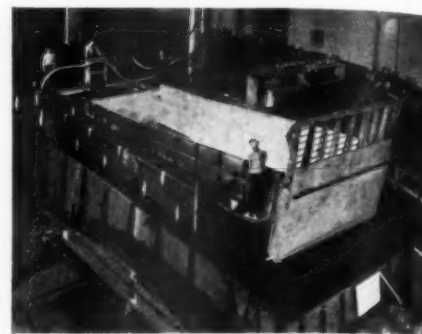
### Navy Barges Launched in 34,000-Gallon Tub At Dry-Land Shipyard

A DRY-LAND shipyard at Warren, Ohio, is producing Diesel engined landing craft for the Navy and launching them in a 34,000-gallon "inland ocean." LCM-3 lighters, fifty-foot barges for landing medium tanks, bulldozers, guns, trucks and personnel, are built at Warren City Manufacturing Company, hundreds of miles from the sea and 50 miles from Lake Erie. Each is tested in a huge steel "bathtub" which cost \$50,000.

The all-welded craft are constructed upside down on a modern assembly line and are then swung over for final fabrication and installation of Diesel engines. After a two-hour test in the launching tank, the barges are loaded on their sides on flatcars and hauled direct to points of embarkation, completely equipped from boathook to anchor.

"Landing craft now has the No. 1 priority in Navy construction," recently stated Capt. R. T. Hanson, U.S.N., inspector of naval material and supervisor of shipbuilding in the Cleve-

land area. "At the beginning of 1944 the Navy had 20,000 such craft," he said, "and needs 80,000 by the end of the year."



View in the Warren City Manufacturing Company plant showing an "LCM-3" barge in final stages of construction prior to its "bathtub" test.

## YES...YOUR SILENCING PROBLEM IS DIFFERENT

Years ago, when Diesel engine spark arrestors, silencers and spark arrester silencers were being developed, we realized that no standardized, all-purpose unit could ever give completely satisfactory performance.

Consequently, we have always designed and built VORTEX exhaust equipment to fit *specific requirements* in order to assure each installation the maximum silence, safety and efficiency prevailing conditions would permit.

That is why today you will find so many VORTEX units in war service . . . particularly marine service, where failure cannot be tolerated.

. . . And why most commercial users of Diesel power are unable to obtain VORTEX products, because wartime needs are taking our entire output.

However, when this war is won, we will be back again applying our wartime experience to the production of even better VORTEX Silencers, Spark Arresters, Spark Arrester Silencers — units "tailor-made" to provide you and the vastly expanded Diesel industry with the most efficient exhaust equipment money can buy.

**ENGINEERING SPECIALTIES CO., INC.**  
39 CORTLANDT STREET • NEW YORK 7, N. Y.



# VORTEX

SPARK ARRESTERS

• SILENCERS

• SPARK ARRESTER-SILENCERS

LCM-3's, weighing about 25 tons, are of sturdy construction enabling them to plow through breakers, ground on a beach in landing operations, and pull off under their own power. Barges of this type have been used to good advantage in the South Pacific and are slated to play an important part in invasion.

During the "bathtub" test, conducted only a few feet away from the end of the barge assembly line, steel cables are attached to keep the craft from leaping out of the tank. A worker standing at the steering wheel and control panel on the rear pilot deck turns the powerful Diesels over slowly, gradually speeding them up for prolonged testing. Water in the tank is whipped into white, boiling foam. The barge strains at its cables, riding up and down on waves it creates itself.

Rail shipment of LCM-3's to the coast presents a problem in traffic. The craft is 14 feet wide, and when loaded into a gondola on its side, reaches a height necessitating devious routes to avoid low bridges and tunnels.

In addition to the LCM-3, Navy production at Warren City Manufacturing Company includes cargo drives, crankcases for Diesel engines, generator bases and frames, transformer housings, destroyer drives, and boilers for destroyer escorts.

### Baldwin Locomotive Announces Executive Changes

THE Baldwin Locomotive Works has announced the election of Frank K. Metzger to Vice President in charge of sales. Mr. Metzger was formerly Divisional Vice President of Standard Steel Works Division, being succeeded in that capacity by John D. Tyson.





## Less Time Out!

Painting muffler stacks is a very expensive operation, considering that engine shut-down often means stopping production. And each time shut-downs are necessary for painting or other causes, muffler corrosion is increased. The first cost of the ordinary muffler is just a start; you go on paying for upkeep.

Fluor Air-Cooled Mufflers under normal operating conditions, require painting only once every year or two. Cooler stack temperatures (less than  $\frac{1}{3}$  that of conventional mufflers) do not cause protective coats of paint to blister and peel off. Dry pre-cooled exhaust gases eliminate the necessity for continuously painting surrounding equipment to protect it from corrosive spray found in those mufflers where water is used for cooling.

Savings in maintenance costs and plant shut-downs alone will more than pay for the Fluor Air-Cooled Mufflers you install.

*All designs of Fluor Air-Cooled Mufflers are fully protected by U. S. Patents & Patents Pending.*

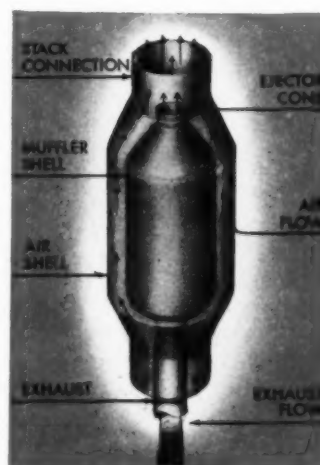


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# SAFEGUARD DIESEL ENGINE PERFORMANCE *with Dependable ADECO* FUEL INJECTION EQUIPMENT



Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.



## ADECO NOZZLE TESTER for LOW-COST MAINTENANCE



America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

Ideal for Testing Hydraulic Equipment

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## Edgar T. Ward's Appoints J. P. Dods

JOHN P. DODS, Director of Research and Advertising Manager for the Summerill Tubing Company, Bridgeport, Pa., has been appointed Director of Advertising and Sales Promotion for the closely affiliated interests of—The Columbia Steel and Shafting Co.—The Edgar T. Ward's Sons Co.—and the Summerill Tubing Company.

Through this change the advertising of these affiliated interests will be better co-ordinated. The Edgar T. Ward's Sons Company is one of the oldest and better known distributors of cold finished steel, with offices and warehouses in ten principal cities from Boston to Milwaukee. It will continue to function, with added facilities, as the Sales Representative and Distributor for the cold drawn bar products of the Columbia mill, and the many types of tubular products produced by Summerill.

Mr. Dods, Cornell '08, has been connected in various capacities with these organizations for many years. He has already assumed his new responsibility in handling advertising, technical literature and other promotive activities, with offices in the Norristown Penn Trust Building, Norristown, Pa.

## New Meehanite Bulletin

THE Meehanite Research Institute of America, Pershing Square Building, New Rochelle, N. Y., has published Bulletin No. 18 entitled "Meehanite—the Metal for Post-War Castings." This four-page illustrated folder describes a variety of recent applications of Meehanite Castings for highly stressed parts, formerly specified as steel or high alloy castings. A copy will be sent free upon request.

## "Midships" To Be Launched In September

THE first edition of MIDSHIPS, the log book of the graduating classes of the United States Merchant Marine Academy, will be published on September 15, 1944. This publication is a 320 page volume, bound in dark blue padded leather, with the seal of the Merchant Marine embossed upon the cover. The extensive training program and activities connected with the cadet corps, are colorfully displayed and shown with what high qualifications our men will officer the ships of the Merchant Service and the Navy. Of the seven hundred graduates included in this Summer's edition, many have already distinguished themselves on board ships of the Merchant Marine. These graduates represent the men who shall guide America's shipping in the future.

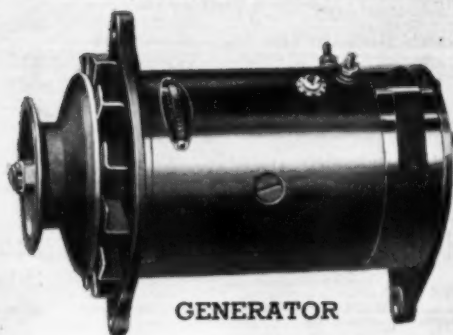


# DELCO-REMY DIESEL ELECTRICAL EQUIPMENT

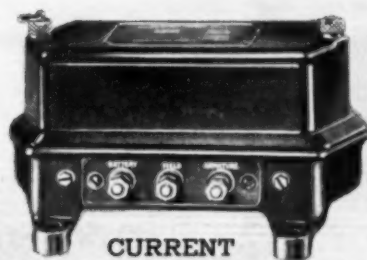
SERIES  
PARALLEL  
SWITCH



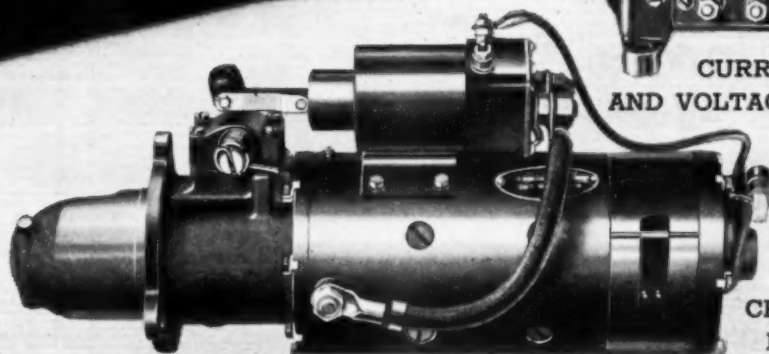
GENERATOR



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## Built to Match the Diesel's Toughness

Where you find the tough jobs you find Diesel-driven equipment. Trucks, high-speed locomotives, tugboats, bulldozers are "naturals" for the stamina, ruggedness and dependability of Diesel power. And wherever Diesels do their work, you'll find Delco-Remy electrical equipment on the job—*because it matches the rugged durability of Diesels themselves!*

Back of Delco-Remy equipment's reliable

performance in the automotive, industrial and marine fields stand years of engineering research . . . years of working closely with Diesel engine manufacturers to design and develop equipment equal to the severe conditions of service in these fields. This unique background of engineering experience has been largely responsible for the outstanding performance of Delco-Remy cranking motors, generators, switches and regulators.

**Keep the Weapons Flowing—Buy More War Bonds!**



# Delco-Remy

DIVISION, GENERAL MOTORS CORPORATION  
ANDERSON, INDIANA

Service on Delco-Remy equipment is available in the United States through authorized service stations of United Motors Service.



**WHEREVER WHEELS TURN OR PROPELLERS SPIN**

### Sticht Company Issues Bulletin

THE Herman H. Sticht Co., Inc., has issued a new bulletin No. 435 describing the model B-5 Megohmer, battery-vibrator type insulation tester. The new bulletin shows the triple color scale, the various models available, and contains a chapter on the value of periodic insulation resistance measurements as recorded on megographs. Those who are interested may secure a copy of Bulletin No. 435 by writing The Herman H. Sticht Co., Inc., 27 Park Place, New York 7, N. Y.

### Caterpillar Announces Important Addition to Its Line

EXTENSIVE and important additions to its line of products have been announced by Caterpillar Tractor Co., Peoria, Ill., to become effective at such future times as military requirements make possible.

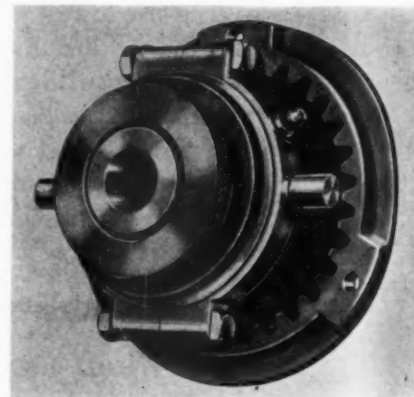
Additions to the "Caterpillar" line, which now includes Diesel track-type and wheel tractors, motor graders, Diesel engines and electric sets, will consist of a wide range of sizes and types

of earthmoving machines—bulldozers, scrapers, rippers and cable control units—matched both to the current sizes of "Caterpillar" track-type tractors and to the present and future sizes of rubber-tired wheel-type prime movers.

Decision to expand its line of products is the result, "Caterpillar" executives state, of the Company's desire to be of maximum service to the earth moving, construction and road-building industries. The newly announced program will make it possible to provide customers with a complete "package" of machinery for earth-moving needs. The bulldozers, scrapers, rippers and cable control units will be matched in capacity to the power of the prime mover. They will be matched in design, materials and workmanship to the high quality of present "Caterpillar" products. They will be priced in keeping with the "Caterpillar" policy of building the best possible machines to be sold to the user at the lowest possible price. They will be sold and serviced through "Caterpillar" Distributors and Dealers, providing the customer with the advantage of a single channel of distribution, a single point of responsibility, and a single source of service and replacement parts.

The new program is partial departure from "Caterpillar's" past practice of relying upon other manufacturers to produce all of the numerous items of machines and equipment that can be pushed, pulled or otherwise powered by "Caterpillar"-built tractors.

### New Bulletin Describes Dodge Rolling Grip Clutch



The Dodge Rolling Grip Friction Clutch.

BULLETIN A-171 issued by Dodge Manufacturing Corporation, Mishawaka, Indiana, describes new Dodge Rolling Grip Clutch now available in two sizes; 1½ hp. at 100 rpm. and 1 hp. at 100 rpm., suitable for use on light machinery and equipment. Bulletin contains photographs, sectional drawings and complete engineering data.

**PRELUDE TO INVASION**  
Born of American ingenuity, these "ugly ducklings" (LST), equipped with Wittek Hose Clamps, are aiding the Allied cause immeasurably as one of the most effective and startling types of ships the war has produced. Official U. S. Navy Photograph.

Type FBC

Type PN

Type RM

Type RW

**Dependable Hose Connections  
For Diesels Assured with**

**WITTEK**

**HOSE CLAMPS**

Because of their design, construction and ease of installation, Wittek Hose Clamps assure dependable hose connections for Diesel engine builders. Long accepted by the automotive and aviation industries, Wittek Hose Clamps are now being proven in actual service with the armed forces of the United Nations as standard equipment for LST's and Half Tracks shown above as well as aircraft, tanks, jeeps, trucks, ships and other combat vehicles. Wittek Hose Clamps are made in many different sizes and types for Diesel applications: Type RW for hose connections of 5" in diameter and larger; Type RM for 3½" to 5"; Type RN for 2½" to 3½" and Type FBC for 2½" hose connections and smaller. Write for complete catalog. Wittek Manufacturing Co., 4305-15 W. 24th Pl., Chicago 23, Ill.

War Bonds for Victory  
Buy MORE in '44!

**WITTEK** **HOSE CLAMPS**  
Dependable Hose Connections



### Ross Heater & Mfg. Appoints A. W. Anderson

ROSS Heater & Mfg. Co., Inc., has appointed Arleigh W. Anderson as Sales Representative for the Southern California territory. Mr. Anderson's offices are at 164 South Central Avenue, Los Angeles 12, California.



Arleigh W. Anderson

The Sales-engineering, and servicing of all Ross equipment, including Heat Exchangers, Condensers, Coolers, Heaters and Steam Jet Ejectors, for Oil Refineries, Power Plants, general industrial use, and the Marine field, will be handled exclusively by Mr. Anderson in the Southern California area. Mr. Anderson takes over Ross representation with a record of long experience in and familiarity with this field. For 22 years he has been actively engaged in the sales-engineering and development of power plant and marine equipment.

This latest addition to the growing list of Ross representatives is in line with the Company's policy of expanding its sales-engineering and service facilities on the west coast, which now include a direct factory office in San Francisco, and representatives in Los Angeles, Seattle (Wash.) and Portland (Ore.).

### Hendy Promotes Dr. L. H. Fuller

APPOINTMENT of Dr. L. H. Fuller as assistant chief engineer is announced by the Joshua Hendy Iron Works. Dr. Fuller, former head of the school of Electrical Engineering at the University of California, has served as consulting engineer to Hendy during the past 16 months. He has a wide industrial and academic background in electrical and mechanical engineering.

### Second "Star"

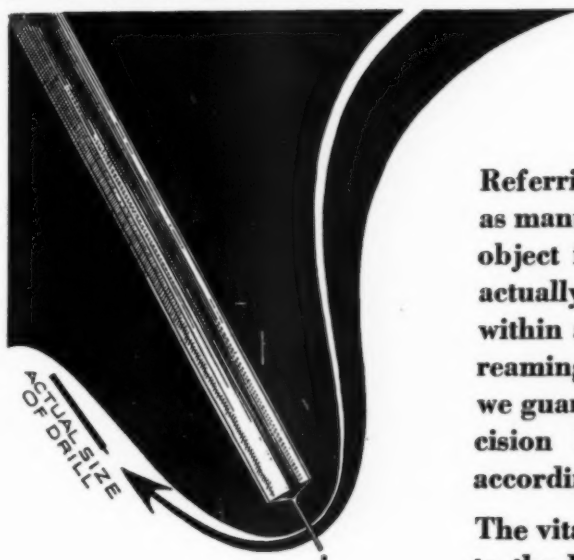
A LITTLE over a year ago, John Reiner & Company, Long Island City, N. Y., was awarded the Army-Navy "E" for the work it was doing in a very specialized field important to the war effort.

Last October, the first "star" was added. Recently, the second "star" was awarded the company for its continued excellent work in designing and building "made to order" Diesel generating sets and power units.

### New Robot Oil Reclaimer Literature

THE Youngstown Miller Company announce that their Bulletin YM-700 covering their new Robot Oil Reclaimer is now available. The Robot employs the process that this company has used in batch oil reclaimers for over ten years—with the new feature that operation is now automatic and continuous. Capacities range from 4 gallons per hour to 300. A copy of Bulletin YM-700 will be mailed upon request to Youngstown Miller Co., Sandusky, Ohio.

## PRECISION *as defined by Webster*



Referring to Precision Pivot Drills as manufactured by us the primary object is to enable an operator to actually drill a hole to specified size within a tenth, (0.0001") without reaming or lapping. That is what we guarantee our microscopic Precision Drills to do when used according to our recommendations.

The vital importance of these tools to the Diesel Industry is an established fact. You can now drill fuel

injection nozzle orifices—accurately; moreover you may expect drill life for an average of 300 to 500 accurate holes—a modest claim when we have records of drilling 3500 holes with one drill.

PRECISION PIVOT DRILLS • PRECISION GUN-TYPE REAMERS • MICROSCOPIC PUNCHES • PRECISION INSTRUMENT PARTS • DRILLING SERVICE • ENGINEERING SERVICE.

"The Only Business of This Kind In The World"

# National Jet Company

115 MILTON PLACE CUMBERLAND MARYLAND

### Oil Well Supply Acquires Witte Engine Works

**OIL** Well Supply Company, a U. S. Steel subsidiary has acquired the Witte Engine Works located at Kansas City, Missouri, Fred F. Murray, president, recently announced. The Witte Engine Works will continue as heretofore in the manufacture of small gas, gasoline and Diesel engines. The acquisition will provide "Oilwell" with a line of engines for oil field pumping and other applications in industrial, agricultural and general usage.

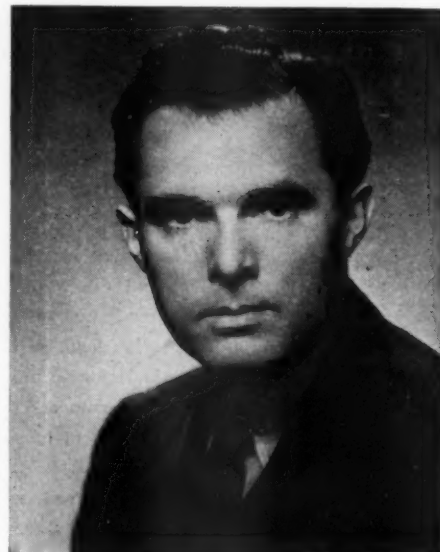
Mr. Edward H. Witte at the age of 77, retires from active direction of the company, which was started by his father in 1870 and from whom he purchased it in 1886. Witte Engine Works is a pioneer manufacturer of small internal combustion engines and has marketed many thousands of them literally all over the world.

Oil Well Supply Company has been continuously identified with the oil business since 1861 in the manufacture of oil well drilling and

producing machinery and equipment, also the distribution of associated products manufactured by others. "Oilwell" operates some 80 branch stores in the oil fields of 27 states, an export business is handled by its New York and London offices. Normally active representation is maintained in a number of foreign countries. Manufacturing plants of Oil Well Supply Company are located at Oil City and Braddock, Pennsylvania and at Oswego, New York.

### Standard of California Appoints New Advertising Manager

**A**PPPOINTMENT of M. Anthony Mattes as advertising manager of Standard of California was recently announced. Mattes, native of New York City, went to junior high school in San Francisco and completed his schooling at Columbia University, New York.



M. Anthony Mattes

His business experience includes positions with the Blackett-Sample-Hummert, Inc. advertising agency and with Norman Bel Geddes Industrial Designers, with which he was business manager. He has also been an advertising executive with one of the largest New York department stores. His latest position before coming to Standard of California was with the Office of Price Administration.

### Nordberg Recognized for Sustained Production

**I**N recognition of continued high standards of quality and quantity production of essential war machinery and equipment Nordberg Manufacturing Co. was recently awarded the Fourth Star for its Navy "E" Pennant and the Third Star for its Maritime "M" Burgee.

## LOST...TO THE SERVICE OF



**135,000,000 AMERICANS!**

Whenever a gasoline or diesel engine is all washed up because of lubrication neglect, every American suffers a loss. We won't go into the causes of lubricating oil failures. Our job is to know how to prevent them, because an engine worn out, is no longer replaceable from the production line.

VISCO-METER\* does a protection job on gasoline and diesel engines. With this simple instrument you have a lubrication safeguard. It tells the lubricating ability (viscosity) of the crankcase oil *visibly* and while the engine is in operation.

VISCO-METER\* offers the one dependable means of making sure of safe, efficient and adequate engine lubrication.

Only VISCO-METER\* can warn in advance of failure...preventing damage and loss of service. So the VISCO-METER\* is important not only for automotive vehicles, but on any gasoline or diesel engine.

If you design, produce or use internal combustion engines of any type, why not request that a VISCO-METER\* engineer call on you to tell you the *whole* story? Write today.

# VISCO-METER

CORPORATION

GROTE ST., BUFFALO 7, N. Y.

\*Fully covered by U. S. and Foreign Patents



# YES...a WALSEAL\* fitting can be removed



Silbraz\* joints are the strongest connections that can be made on brass or copper pipe or tubing. In hundreds of installations, Walseal Valves, Fittings or Flanges for making Silbraz joints (patented products of the Walworth Company), have proven their ability to withstand severe shock and vibration, resist corrosion and remain tight and leakproof.

But when a Walseal fitting must be removed to make alterations or repairs, it can be easily done. To remove a Walseal flange, for example, heat around the entire hub of the flange, with an oxy-acetylene flame, until the hub turns a dull red color. Direct little or no heat to the pipe or tube. The flange is then given a slight shaking motion by a helper, using hooks. The shaking motion of the heated flange breaks the brazed joint and allows air to enter between the parts, quenching the alloy. The flange may then be removed.

The flange may be re-used in the same or a new position. Enough alloy usually remains in the insert groove to permit a second joint to be made, without the necessity of inserting additional alloy.

For complete information on the installation of Walseal valves, fittings and flanges, send for Bulletin No. 84.

\*Registered Trade Marks.

## SEND FOR CATALOG

You'll find pertinent information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches in the new Walworth Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts

easier. Write, on business stationery, for your free copy. Address: Walworth Company, 60 E. 42nd St., New York 17, N. Y. Dept. 620.



# WALWORTH

## valves and fittings



DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

### Massey Machine Announces New Catalog

MASSEY Machine Company announces Catalog No. 44R featuring its new Type-R Centrifugal governors. Three sizes of the new Type-R governors are listed, having speed ranges of 1500-3000, 1250-2500, and 600-1200 and work capacities of 94, 197 and 487 inch-lbs. respectively. Eighteen outstanding features of these new governors are listed. The catalog also covers the Type H-3 Hydraulic-Isochronous gov-

ernor, Type T-2 centrifugal governor and Jahns Class C and Massey Class S governors. Those who are interested may secure a copy of Catalog No. 44R by addressing requests to Massey Machine Company, 783 Pearl St., Watertown, N. Y.

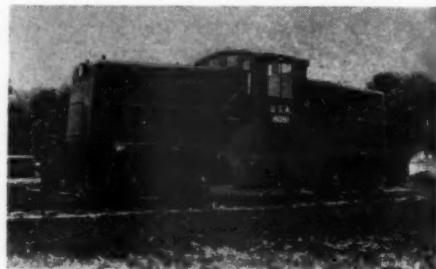
### New "Alnor" Bulletin

ILLINOIS Testing Laboratories, Inc., has issued a new, four-page, 2-color bulletin embodying illustrations with brief descriptions of

its complete line of instruments which includes Pyrometers for all types of service, Electrical Resistance Thermometers, Temperature Controllers and the "Alnor" Velometer, a direct-reading air velocity meter. In addition to a variety of multi-point engine and board mounting Pyrometers there is an interesting group of portable Pyrometers in the "Alnor" line. Address requests for Bulletin 2982 to Illinois Testing Laboratories, Inc., 420 North La Salle St., Chicago 10, Illinois.

### Powerful Diesel Locomotive Disguised to Fool Enemy Fliers

CAMOUFLAGE makes them look like box cars but actually these are powerful Diesel-electric locomotives when they are transported into action on the battle fronts of Europe. Whitcomb Diesel-electric locomotives, built by a subsidiary of The Baldwin Locomotive Works, are so important in military work with our armed forces in Iran, North Africa and Italy that it has been necessary to cloak them from enemy planes, according to Ralph Kelly, president of Baldwin. These locomotives, Mr. Kelly said, being used in large numbers as all-purpose locomotives are designed for continental tunnel clearances.



On African and European battle fronts these Whitcomb Diesel-electric locomotives provide motive power for the transportation of fighting men and materiel. In accompanying picture the locomotive is shown camouflaged as a continental box car to deceive axis bombing planes.



Camouflage makes this look like a box car but it actually is a powerful U.S.-built Whitcomb Diesel-electric locomotive.

# 3 REASONS

## for Using Standard Twin Disc Clutches!

1. By specializing in clutch manufacture the clutch specialist is able to combine the economies of volume production with the maximum in performance and wear-life qualities.

2. By eliminating the use of "Specials" you assure complete replacement parts stocks with a moderate investment. Thus the clutch specialist is prepared to give you the best of service . . . supply needed parts at moderate prices.

3. By working closely with the designer of internal combustion engines and various types of industrial machinery and equipment, the Twin Disc Clutch Company has developed a complete line of friction clutches which meets every need. Their record of performance in the industrial fields is your assurance of uniformity and adequate wear-life.

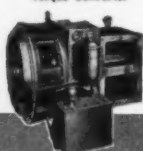
That's why, in the designing of a new piece of equipment, you'll find it to your advantage to use Standard Twin Disc Clutches. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



Reduction Gear



Hydraulic Torque Converter



Marine Gear





# *Announcing* the Goetze Gasket Film **"Only A Gasket"**

with Commentary by  
**LOWELL THOMAS**



Now released for showing throughout the country.

Available to employee groups, technical societies, engineering schools, and other organizations.

This 35-minute, color and sound film tells the story of the tremendous importance of these "biggest little things" in Industry. Of the research and manufacturing facilities employed in this highly-specialized business of sealing the joints in vital equipment against the effects of high temperatures, pressures, corrosion and other service conditions.

Write for full information.

**GOETZE GASKET & PACKING CO., Inc.**  
32 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY



*Goetze* for **GASKETS**

"America's Oldest and Largest Industrial Gasket Manufacturer"



## Detroit Diesel Delivers 100,000th Engine

THE 100,000th Series 71 6-cylinder, 2-cycle Diesel engine manufactured by the Detroit Diesel Engine Division of General Motors Corporation was dedicated to the late Frank Knox, Secretary of the Navy, by W. T. Crowe, General Manager of the Company on June 5th. The power plant was presented to the U. S. Navy by Mr. C. F. Kettering, Vice President of General Motors Corporation and was ac-



Left to right; W. T. Crowe, general manager, Detroit Diesel Division G.M., Rear Admiral H. G. Taylor, and C. F. Kettering, Vice President G.M. as 100,000 Diesel landing craft engine is dedicated to the late Frank Knox and presented to the Navy.

cepted for the Armed Forces by Rear Admiral H. G. Taylor.



W. T. Crowe

A celebration in honor of the dedication and delivery of this engine was witnessed by Detroit Diesel employees as they pledged to buy bonds in the 5th War Bond Drive in an amount

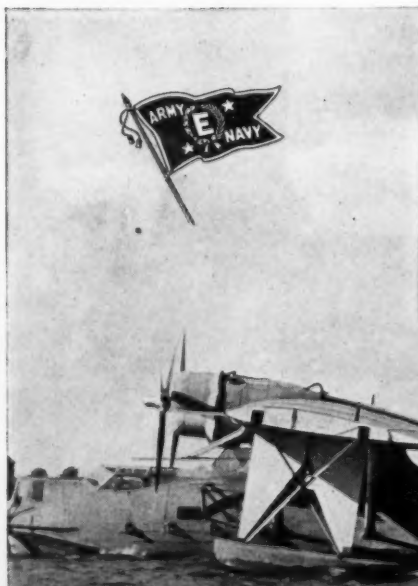
equal to the purchase price of an LCI. Also participating in the dedication and bond pledge were R. K. Evans, Vice President of the General Motors Corporation; V. Genn, Sales Manager of Detroit Diesel, Frank Isbey, head of Detroit's Fifth War Loan Drive, and James Fargo, Union representative.

The 100,000 engines delivered to date represent power for propelling the Navy's LCI, each of these craft being driven by eight Series 71 6-cylinder engines, in the form of two Quads with two single sixes in reserve to replace a damaged unit. The Quad, designed by Detroit Diesel engineers, is a unique combination of four standard 6-cylinder engines coupled to a single propeller shaft, thus increasing horsepower fourfold with important reductions in weight and space.

## G.E. Supplies First Full-Sized Diesel-Electrics Ever Used In Hawaii

TWO 47-ton 380-hp. Diesel-electrics made by the General Electric Company have been added to the fleet of approximately 25 steam engines operated in Hawaii by the Oahu

# FILL 'ER UP... MACK! The Tough Jobs go to MACK MARINER DIESEL



MACK Mariners sum up more than 44 years of engine building experience. They're full powered, yet compact and economical to run. Built specifically for marine operation . . . they are setting enviable records for efficiency and durability. Mack Mariners range in size from 65 to 100 h.p. . . . conservatively

rated on a continuous duty basis. Quoted starting—4 cycle efficiency. Direct factory branch service available at 28 ports of water and 14 fresh-water ports.

MACK MANUFACTURING CORP., MARINE ENGINE DIVISION  
LONG ISLAND CITY, N. Y.

Atlas Imperial Diesel Engine Company are distributors of Mack Marine Diesels in British Columbia. 1927 Georgia Street, Vancouver, B. C.

Catalina Flying Boat of the Royal Air Force Ferry Command sits down for a long drink of powerful aviation gasoline. Ready with 200 Imperial gallons of that gasoline is the 43 foot fueling boat "Servishell." Powered by a 70 h.p. Mack Mariner Diesel (model END 47) with a three to one reduction gear . . . the "Servishell" is equipped with a discharge pump operated by a power take-off from the Mack



# Mack → DIESEL MARINE POWER



of an LCI by & Land Company. These "mighty mid-  
gation and the first full-sized Diesel-electrics for gen-  
Vice Presi railroad use ever brought to the Islands,  
already hauling war materials, sugar, and  
it Diesel, Frapples. The locomotives, ordered last  
War Loan Damer, were shipped from the United States  
representative.

to date rep  
Navy's LCI b  
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engines couple

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the new units were specially adapted by G.E.  
standard gage to the 36-inch O. R. & L.  
cks. Power is developed from two eight-  
nder, 190 hp., 1000 rpm., Caterpillar  
el engines, with electric drive to each of  
four axles. Each unit has a fuel capacity  
250 gallons, sufficient for about 50 hours  
service without refueling.

the new additions to the O. R. & L. rolling  
ck will be used regularly in the transporta-  
of war materials and other freight to  
inations served by the railway, and in haul-  
supplies from plantations and mills to the  
as in Honolulu and the pineapple can-  
ies.

basis. Qu  
Direct  
le at 28  
ports.

**Goulds Announces New Line Rotary Pumps**  
Goulds Pumps, Inc., has announced the  
tion of a new line of rotary pumps of the  
ble helical or herringbone gear type which  
designed to handle liquids which possess  
erent lubricating qualities. The pumps are  
able in ten sizes ranging from that with a  
half inch suction and discharge and with a  
city of from one to one and one half gpm.  
the two and one half inch type with capacity  
ing from fifty to seventy-five gpm. Maxi-  
m working pressures in all sizes is given as  
h. All sizes are obtainable for direct drive  
ugh flexible coupling or for belt drive.

ures of the new rotary pumps include their  
licity of construction involving but two  
ng parts, a split bolted type gland, renew-  
bearings and built-in relief valve. All are  
tionally quiet in operation.

addition to the standard fitted type all



47-ton Diesel-electric locomotive, powered by two Caterpillar Diesels—first of its type in Hawaii.

pumps are also available with all parts of iron or steel or in all bronze construction.

Complete descriptions and specifications of the new line of rotary pumps is contained in Goulds Bulletin No. 643, copy of which may be obtained by writing Goulds Pumps, Inc., Seneca Falls, N. Y.

### Petroleum Solvents Announces New District Managers

THE Petroleum Solvents Corporation, makers

of Siloo and Loosite—solvents for petroleum residues—announced the following additions to their sales staff: *West Coast*—operating under Irving Tick, Western District Manager: Pete Hunt of Los Angeles, formerly with Associated Oil Company and Union Oil Company. Robert Christenson of Seattle, formerly with Thermoid Rubber Co. *East*—operating under Sam E. Samuels, Eastern District Manager: Louis G. Knowles, in charge of New England territory. *Midwest*—operating under Harry French, Midwest District Manager: B. P. Kehoe of Chicago.

## STRETCHING the Engine Hours

### ... of Diesel Locomotives

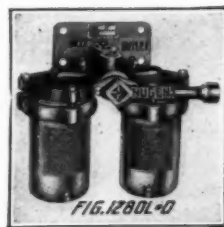
Locomotive designing engineers are adding hours to the life of Diesel switchers and Diesel locomotives when they specify Nugent Filters for Diesel engines. These filters help to provide the kind of lubrication that protects engines, steps-up efficiency and saves oil.

Nugent Duplex Fuel Oil Filters and Lube Oil Filters are ideal for all types of Diesel locomotives. Patented features give these filters 20 times more filtering area

than most filters of comparable size, insuring 20 times longer periods of time without attention of any kind. Nugent Filters do not remove any of the special additives which have been embodied in the oil—yet the special woven, lintless filter element removes particles as small as .0003" to produce 99.8/10% clean oil.

Nugent Filters are available in a wide range of sizes and filtering capacities for every type of job. Write for Bul. 7A.

### for Fuel Oil



Records show that Nugent Duplex Fuel Oil Filters operate 448 engine hours before changing filter recharges when filter is installed in pump suction and discharging filtered oil at 35 psi winter and summer (New England States).

Fuel Oil injection system is free from dirt, wax and scoring. Analysis by engine builder of foreign matter removed shows:

Lead .....	43.90 %	Iron Oxide .....	6.78%
Sulphur .....	.095%	Carbon Dioxide .....	14.95%
Water Soluble Extract .... 17.87%			

**WM. W. NUGENT & CO., INC.** 415 N. Hermitage Ave. Chicago 22, Illinois

### ... for Lubricating Oil



Records show that Nugent Absorbent Type Lubricating Oil Filters operate 700 engine hours before changing.



# NUGENT FILTERS

SINCE 1897

## Large Chain Drive For Marine Propulsion

OVER ten thousand parts go into the assembly of this marine propeller drive for the U. S. Navy's 110-foot harbor tugs. In the largest application of its kind, this drive couples two direct-reversing Diesel engines to



Chain drive assembly comprised of more than 10,000 parts for 110 ft. Navy Diesel-propelled harbor tugs.

a single propeller with 3 to 1 reduction, and provides outstanding advantages in efficiency, economy and flexibility of engine room layout.

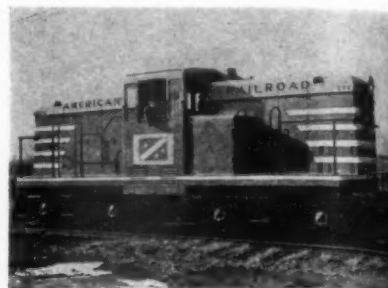
Perfect matching, elimination of "take-up" and 100% interchangeability of chains is obtained by precise specifications and new manufacturing methods developed by the Morse Chain Company. Similar drives in small Navy vessels are building up enviable performance records and many leading naval architects are enthusiastic over the possibilities of chain drives for fishing boats, tugs and Diesel-propelled cargo vessels.

## B-W Superchargers, Inc. Is New Name for McCulloch Engineering

THE Board of Directors of McCulloch Engineering Corporation has announced that, effective June 20th last, the name of the organization was changed to B-W Superchargers, Inc. The change in name involves no change in personnel with R. J. Minshall, president, and J. P. Stewart, assistant general manager, or in the company's present affiliation with Borg-Warner. The new name marks the end of a period of

development of both product and organization and the beginning of the production stage of the growth of this concern.

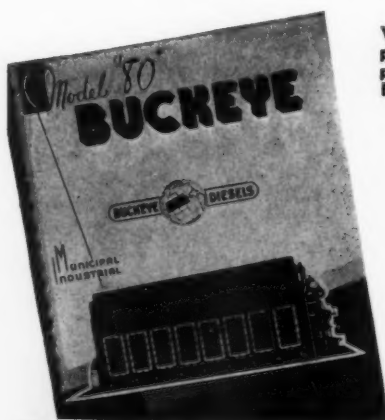
## G.E. Furnishes Diesel-Electric Switchers to American Railroad of Puerto Rico



THIS is one of twelve 380-hp. road-switcher Diesel-electric locomotives built by the General Electric Company, and recently placed in service by the American Railroad of Puerto Rico. Each unit weighs 47 tons, and is powered by two Caterpillar Diesel engines direct-coupled to GE generators. Power is furnished for GE traction motors. Geared for 35 mph, the locomotives perform road and transfer work as well as doing all the switching and classification of the trains they handle.

Buckeye Diesels have been known through the years as dependable and unusually economical power units—so proved in almost every type of installation where these qualities mean greater savings and higher profits. Under the stress of war-time power needs—however good Buckeye Diesels have been—we are learning how to build them better; years of experience are being telescoped into these war months to the end that better Buckeye Diesels will be available to power all kinds of peacetime industries.

Direct Drive or Electric Units 75 hp to 960 hp



Write for your copy of this 32-page illustrated engineering and application bulletin on Model "80" Buckeye Diesels.



ENGINE  
BUILDERS  
since 1908

Be Profitwise and Dieselize with Buckeyes  
THE BUCKEYE MACHINE COMPANY . . . . LIMA, OHIO



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Electric  
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. road-switch  
by the Gen  
placed in  
of Puerto R  
is powered  
direct-comp  
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35 mph, the  
transfer wa  
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## Maritime "M" To Crocker-Wheeler

National Maritime Day, May 22, 1944,  
United States Maritime Commission pre-  
sented to Mr. Frank W. Mencik, factory super-  
intendent of Crocker-Wheeler Electric Manu-  
facturing Company, Division of Joshua Hendy  
Works, the Maritime Commission "M"  
Burgee and the Victory Fleet Flag on behalf of  
Crocker-Wheeler workers. A presentation  
made by Mr. A. D. MacLean, Director,  
Production Division, United States Maritime  
Commission with Mr. A. J. M. Baker, General  
Manager of the Crocker-Wheeler Electric Man-  
ufacturing Company presiding.



Crocker-Wheeler employees and officials proudly  
display the Maritime "M" Burgee just pre-  
sented to them.

The "M" award was given for the manufacture  
and development of specially designed electri-  
cal equipment for Maritime Commission ships.  
This award carries with it the coveted privi-  
lege of flying the Maritime "M" pennant and  
the Victory Fleet Flag.

Among those present at the ceremony were  
Glen Treat, Chief of Motor Section, War  
Production Board, Washington, D. C., the Hon.  
Charles H. Martens, Mayor of East Orange;  
L. Lucke, United States Navy; Lt. Gardner,  
United States Army.

## Pedrick Names Warren Lee Factory Manager

WARREN K. LEE, for more than 12 years in  
Engineering Service for the Wilkening Manu-  
facturing Co., maker of Pedrick piston rings,  
has been appointed Factory Manager at the  
company's Philadelphia headquarters.

Recently, Mr. Lee has been project engi-  
neer, and, after completion of the D.P.C. plant  
by the company at Scranton, Pa., he was  
Factory Manager there. From Scranton, Mr.  
Lee brought with him three production engi-  
neers and other production men to round out

# See for Yourself

what POW-R-FLO will SAVE You!

Without cost or obligation, our Engineering Service will make a demonstration  
test of POW-R-FLO Prescribed Lubrication on one of your Diesel Engines in  
use. Then YOU be the Judge of its SAVINGS in fuel and upkeep costs.

**POW-R-FLO**  
THE SUPPLEMENTARY LUBRICANT  
Makes Engines run CLEANER, SMOOTHER,  
LONGER

POW-R-FLO is not a "dope" or tune-up "miracle worker". It is a highly efficient  
internal engine LUBRICANT with a retarding and detergent action on combus-  
tion residues that cause most engine troubles. It blends and cooperates with  
correct lubricating practice for more efficient engine performance. Added to  
regular lubricating oil — as prescribed — POW-R-FLO assures these results:

1. **MORE COMPLETE, EFFICIENT** lubrication of entire engine.  
POW-R-FLO has a HIGH CAPILLARY action that penetrates into the close tolerance and  
super-heated internal engine surfaces.
2. **INCREASED** film strength in the oil used.  
POW-R-FLO is tough and heat-resisting—free of all impurities.
3. **Minimum** film friction—even with heavy oils.  
POW-R-FLO has unusual and lasting "oiliness"—lubricating efficiency.
4. **CLEAN** oil for much longer periods of operation.  
POW-R-FLO greatly reduces sludge accumulations when used with correct type of oil for  
each engine. It keeps sludge in suspension for easy removal by filter.
5. **A CLEAN, EFFICIENT, FREE-RUNNING** engine.  
POW-R-FLO retards and dissolves carbon binders, gum deposits and piston varnish. Less  
frequent overhauling required, less "down" time.
6. **Absolutely No Harm** to Engine.  
POW-R-FLO cannot possibly injure metal surfaces, no matter how much is used. "Over-  
doses" only increase the benefits.

## PROVED in the Toughest Tests

POW-R-FLO has many enthusiastic users — in Industrial, Railroad, Mine and  
Over the Road Service. Their experiences indicate operating and maintenance  
SAVINGS that are too definite and too important for you to overlook. Write  
for full information.

*The Mauston Corporation*

WINONA MINNESOTA

the Philadelphia organization in order to take care of constantly increasing production.

Warren Lee has a wide acquaintance among executives in the engineering, experimental, service and purchasing departments of many vehicle and engine factories. He is a graduate of Cornell University with an M.E. degree and was lieutenant in the U. S. Army Engineers Corps in World War I, spending 1½ years overseas.

### Metals Specialist Joins Cooper-Bessemer

THE appointment of William F. Lamoreaux to the position of Research Metallurgist has just been announced by The Cooper-Bessemer Corporation. Lamoreaux, who for the past three years was Director of Research for the Meehanite Metal Corporation, will divide his time between the company's two plants. At the outset, he will undertake an even closer integration of the company's engineering,

metallurgical and foundry efforts which already produced many notable developments in foundry technique.



William F. Lamoreaux

In addition to his research work, Lamoreaux will specialize in exploring the application of high-duty iron castings to various phases of industry, particularly in the mining and chemical fields, where it appears likely that advanced foundry technique and metallurgical progress will afford new, worthwhile advances in the use of high-duty iron castings in a variety of services.

William F. Lamoreaux's background suits him ideally for these important responsibilities at Cooper-Bessemer. Prior to his connection with the Meehanite Metal Corporation, he enjoyed considerable success for the five previous years as a consulting chemical and metallurgical engineer following his position, from 1930 to 1936, as Vice President and General Manager of the Ducktown Chemical and Iron Company, Copperhill, Tenn.

### Tube Turns Issues Maritime Fittings Catalog

TO meet requests for a book covering welding fitting dimensions specified in Naval and maritime shipbuilding, Tube Turns, Louisville, Kentucky announces its new maritime fittings catalog No. 112. Section 1 of this 48-page plastic-bound book contains dimensional data on seamless wrought steel and wrought steel fittings. Section 2 gives similar coverage on wrought carbon molybdenum alloy steel. The section is fully indexed and is complete.



"Chicago" Ported Valve Tappets are being used extensively in diesel and gasoline engine fields. Over years of service and under severe conditions these tappets have proved that they can "take it". . . In specifying valve tappets—there are many advantages to be gained by insisting upon "Chicago" Ported Valve Tappets. These quality products are made from a special grade of alloy cast iron, assuring uniform "clear chill" depth at the cam face . . . The "porting" feature of these tappets has a definite advantage in providing lubrication of tappet guide holes.



Exacting inspection operations guarantee machining and grinding to the highest standards of quality. . . "Chicago" Ported Valve Tappets are made in a wide range of sizes to meet our customers' individual specifications.



## THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE

CHICAGO, ILL.





### Tube Turns' New Marine Bulletin

with cross section illustrations of each fitting. Bulletin No. 112 will be mailed on request to Tube Turns, Louisville 1, Kentucky.

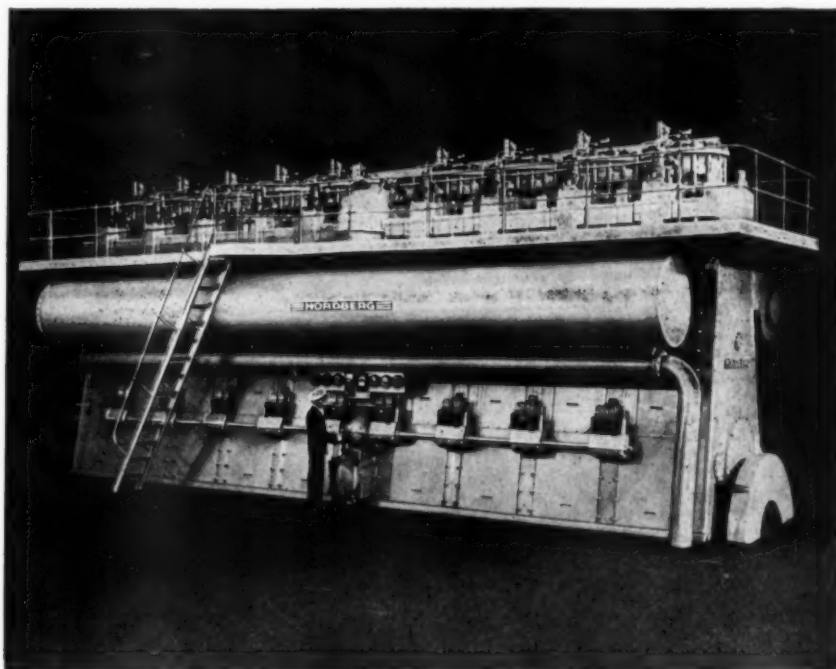
### E. C. Bayerlein Completes Fifty Years with Nordberg

EDWARD C. BAYERLEIN, Vice President, Nordberg Mfg. Co. completed a half century of service with the company on May 29. Mr. Bayerlein was honored on this noteworthy occasion with a party at the Wisconsin Club, Milwaukee with 75 company officials, branch managers and department heads in attendance.



E. C. Bayerlein on the fiftieth anniversary of his joining Nordberg Mfg. Co. is seen in his office surrounded by tokens of esteem from his associates.

Mr. Bayerlein attended high school in his home town of Kilbourn, Wisconsin, and studied accounting at University of Commerce and Finance in Minneapolis. He entered employ of Nordberg May 28, 1894 doing general office and pay roll work and was soon advanced to



## Rely on

## Alnor Exhaust Pyrometers

This Nordberg Marine Diesel is America's most powerful single acting Diesel engine, delivering 6000 shaft horsepower. As in so many other installations, afloat and ashore, the reliable protection of Alnor Exhaust Pyrometers is provided. Accurate, dependable exhaust temperature indication helps in maintaining continued high efficiency operation, and offers a quick check of adjustments.

There is a wide range of dependable Alnor instruments, adapted to any type of engine installation.

Write for special bulletin 2819 with data on all types.



Type RT switch-board type exhaust pyrometer. Capacity up to 28 circuits.

## ILLINOIS TESTING LABORATORIES, INC.

420 North La Salle Street  
Chicago 10, Illinois

assistant bookkeeper, then head bookkeeper and office manager. In 1911 he was elected treasurer and in 1914 given additional responsibility by being made a vice president. Has been active in the field of accounting, having helped establish a certified public accountant's law in Wisconsin. He helped found the Milwaukee Society of Accountants and Bookkeepers and served the organization as president. In the industrial management field he aided in promoting the Wisconsin plan for apprentices in

industry. He is a past president and at present member of the Board of the Milwaukee Branch of the National Metal Trades Association.

### Soviet Representative Approves Generating Plants After Tests

**SCHEDULED** for shipment to Russia are 24 more complete generating units, powered by 8-cylinder, 600 horsepower, Cooper-Bessemer Diesel engines. Another contract for 26 units was recently completed. The 24 new units have been accepted by the U. S. Treasury

Dept. and approved by the Soviet Purchasing Commission through its representative, Mr. N. I. Vasiliev, for use as power plants where electrical energy is needed for both reclamation and normal uses in cities and towns recovered and being recovered by the advancing Red Army.



Mr. M. Henkin, special Russian representative for The Cooper-Bessemer Corp. (at left), Mr. L. G. Peterman, U. S. Treasury Department inspector (center), and Mr. Vasiliev.

Mr. Vasiliev was present at the Cooper-Bessemer plant when complete engineering tests were made on March 27th. Present also at the engineering tests in Mount Vernon were R. M. Sterrett of the U. S. Treasury Department, P. R. Letz, Cooper-Bessemer Works Manager and other engineering and technical men who have contributed to the design and manufacturing of the generating units.

The 600 horsepower Cooper-Bessemer Diesels are of the vertical, four-cycle type, each direct driving a 400 kilowatt, 50-degree centigrade, three-phase, 50-cycle, 400/230 volt, 375 revolutions per minute synchronous generator. Each generator is also equipped with its own V-belt driven exciter, this being 7.5 kilowatt, 40-degree centigrade, 125-volt, two wire and operating at 1750 revolutions per minute. Final installations will be mounted on standard reinforced concrete foundations.

### A New Era in Flow Rate Measurement

**FISCHER & Porter Company** offers a new, highly-interesting, highly instructive catalog on the F&P Rotameter, the area-type flow meter that has gained such widespread acceptance for accurately measuring the flow rate of liquids and gases. This catalog—10-B, entitled "A New Era in Flow Rate Measurement" contains 32 pages of the latest authoritative information on this remarkable instrument.

Each basic advantage of the Rotameter is thoroughly discussed . . . How it works . . . Its extremely high accuracy . . . How it can be made

**AMERICA'S ONLY  
RADIAL AIR-COOLED  
DIESEL ENGINE**

**No Fire Hazard**  
**Lower Fuel Consumption**  
**Increased Striking Range**  
**Greater Stamina**  
**Dependable Operation**  
**Instant Response to the Throttle**  
**No Ignition System**  
**Lower Cost of Fuel**  
**Constant Torque at All Speeds**  
**No Radio Interference**

**SAFE LIGHT WEIGHT DIESEL**

**POWER**

**FOR TANKS • FOR PLANES • FOR SHIPS**

Using fuel that will not burn even when exposed to open flame, the Guiberson completely eliminates the usual fire hazard from the power plants of tanks, planes and ships, and there is no ignition system to cause sparks or interfere with radio operation. Weighing less than two pounds per horsepower, the new light weight Guiberson diesel hits harder, faster, farther. Safe and dependable, Guiberson powered equipment is hitting the Axis on the battle lines of the world and is ready to serve on land, sea and in the air.

***Guiberson U.S.A.***

ESTABLISHED 1910

**GUIBERSON DIESEL ENGINE COMPANY**  
Dallas, Texas

**THE GUIBERSON CORPORATION**  
Aircraft and Heater Division

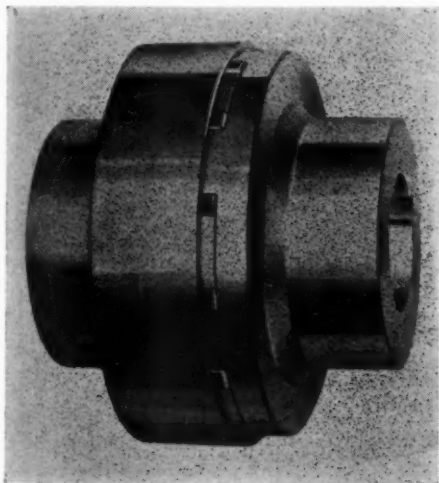


immune to variations in viscosity and specific gravity. Large, semi-humorous illustrations dramatize each point to make it readily understandable. A list of fluids successfully handled and some typical applications are included.

This complete, absorbing catalog 10-B contains information invaluable to engineers with flow rate problems. A copy is readily obtainable, without obligation, by writing to Fischer & Porter Company, 941 County Line Road, Hatboro, Penna.

### Important New Protection in Lovejoy Type "C" Coupling

**PROTECTION** that secures operators against the catching of clothing, or incautious handling is embodied in the new L-R Type "C" shrouded flexible coupling announced by Lovejoy Flexible Coupling Company.



*L-R Type "C" flexible coupling with newly designed protection.*

The essential feature of this new protection is the outside steel collar which holds the load cushions in place. An extension of this collar which encircles the coupling, safeguards material and fingers from the heads of the bolts that secure the load cushion retainer. The boltheads are concealed, yet easily and conveniently reached when necessity arises. This improvement effects more compact design with overall smoothness of external surface.

Cushions are always in sight. In operation half the cushions are idlers (except on reversing load). A new set of cushions is therefore always ready. No shutdowns for changing. No lubrication is required.

Literature and engineering information is now available on the new L-R Type "C" couplings on request to Lovejoy Flexible Coupling Company, 5009 West Lake Street, Chicago 44, Ill.



## This Ex-Cell-O Diesel Pump Feature Provides for Maximum Efficiency and Fuel Economy at All Engine Speeds

For variable speed applications such as Diesel-powered vehicles and motor ships, the automatic timing feature in the Ex-Cell-O type KB fuel injection pump provides for maximum power output and minimum fuel consumption by advancing fuel injection timing according to engine speed. Speed-responsive timing materially results in smooth, flexible operation throughout the operating range and increases the service life of vital engine parts. For applications not requiring automatic timing, the Ex-Cell-O type KD pump provides the same high degree of dependability and efficiency. Both of these war-proved pumps reflect Ex-Cell-O's quarter century of precision production and years of experience in the Diesel field.

The Ex-Cell-O nozzle is a worthy complement to Ex-Cell-O pumps, specifically designed for efficiency, dependability and trouble-free service.

For complete information, engine builders should address Diesel Division, Ex-Cell-O Corporation, Detroit 6, Michigan.



**EX-CELL-O  
DIESEL FUEL INJECTION  
EQUIPMENT  
EX-CELL-O CORPORATION - DETROIT**



### Merrihue Named Manager G-E Apparatus Advertising and Sales Promotion

**WILLARD V. MERRIHUE** has been named manager of the advertising and sales promotion divisions of the Apparatus Department of the General Electric Company, it was announced by the company May 3. Simultaneously he was named a member of the apparatus sales committee of the company. He was previously assistant to the manager of the apparatus publicity divisions, Robert S.

Peare, whose election as vice president in charge of the company's advertising, broadcasting and general publicity activities was previously announced.

Mr. Merrihue started work in the editorial section of the company's publicity department in Schenectady in 1925, immediately after his graduation from the University of Pennsylvania with a degree of bachelor of science in chemical engineering. In 1930 he was named assistant manager of the industrial advertising



Willard V. Merrihue

## Something New in VIBRATION CONTROL

### A SIMPLIFIED ALL-DIRECTIONAL VIBRATION ISOLATOR

Korfund engineers have designed the new Model SL Vibro-Isolator to utilize the advantages of four well known models of Korfund Vibration Control within one simplified unit—thus providing a mounting capable of absorbing vibration in all directions at unusually low cost.

Steel springs, with the usual Korfund adjustment feature, for the control of vertical vibration, combined with self-adjusting isolation members for the control of lateral vibration, are incorporated within the all-welded structural steel housing of the new Model SL mounting.

This new unit will be found useful for all purposes and particularly in marine equipment installations where the forces due to rolling and pitching of the vessel must be taken into consideration.



Write Dept. D for full particulars.

**THE KORFUND COMPANY, INC.**  
48-24 THIRTY-SECOND PLACE LONG ISLAND CITY, I, NEW YORK

section of the department, and in 1933 was appointed division manager of central station advertising. In 1939 he became assistant to the manager of the publicity department, in charge of the apparatus division, which position he held until his new appointment. In 1933 he received a Charles A. Coffin Foundation Award of the company for "initiative, ingenuity and perseverance in devising a new and unusual sales plan."

### Unique Wartime Batteries Revealed

**KEPT** secret until now for reasons of wartime security, certain revolutionary new storage batteries developed for the Army and Navy by the Willard Storage Battery Company.

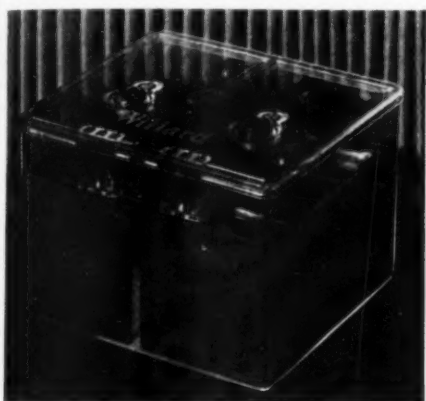
Created to meet special needs of the Armed Forces, these unusual models embody many advanced features. It is possible that several of these features, having proved their value in military and naval service, may figure in battery construction after the war.

An outstanding characteristic of the new batteries is their high electrical capacity in relation to their size. One of the batteries is only 29/32 of an inch high and weighs only six ounces—the tiniest high-voltage storage battery in commercial production.

All of the batteries disclosed have polystyrene plastic containers, which Willard engineers pioneered well before Pearl Harbor. In addition to the advantage of transparency, the easy-to-clean plastic containers are immune to the corrosive effect of electrolyte, are lighter than glass and stronger than hard rubber.



Most of these wartime batteries use Fibrite, a remarkable new insulation developed from non-critical materials. Fibrite insulation absorbs 90% of the electrolyte within a cell. Complete non-spill construction is achieved by extending the walls of the vent tube downward in such a manner as to trap the 10% of the solution remaining free. Tipped upside down, as in a plane or in a soldier's pocket, these batteries do not spill electrolyte. Because the Fibrite insulation absorbs so much of the electrolyte and keeps it in contact with plates, these batteries continue to function when their containers are cracked, broken—or even shot away.



This new-type battery measures 6 1/4 in. long, 5 1/2 in. wide, and 4 3/16 in. high, and weighs 11 pounds. Its capacity is 42 ampere hours at 20-hour rate, 4 volts. It has built-in specific gravity indicator.

These new-type plastic-container batteries are currently serving many branches of the Armed Forces in a great range of applications. They are used in Walkie-talkies, field radios, meteorological devices, gun-firing devices, gyro-compass controls and in a wide variety of electronic devices. Many other applications must remain secret for the duration.

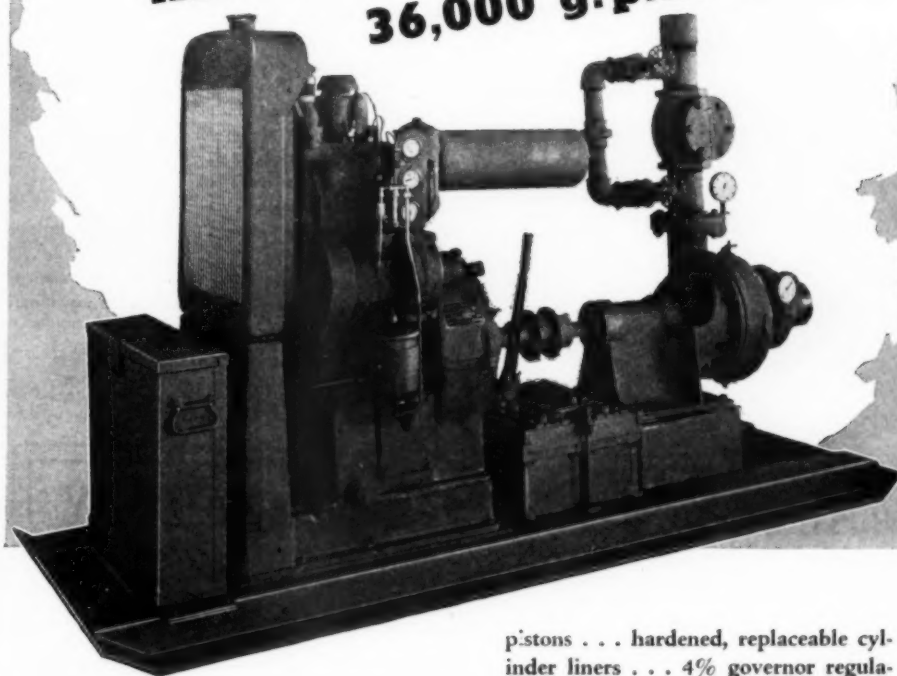
#### Penn Receives Third "E" Award

EMPLOYEES and officials of Penn Electric Switch Co., Goshen, Indiana, were again honored by the Army-Navy Production Board by the renewal of their Army-Navy "E" Award. This award gives the company a second white service star affixed to the "E" flag and signifies continued excellence in the production of war material.

A large part of Penn's production output is the manufacture of complete electrical control circuits for naval guns. These units include the necessary switches, solenoids, transformers, lights, firing triggers, etc., necessary to the operation and firing of the 3 in. and 5 in. guns used by naval vessels as well as cargo ships.

**A BIG NICKEL'S WORTH OF DEPENDABLE POWER!**

## *Sheppard Diesel Driven Allis-Chalmers Unit Pumps* 36,000 g.p.h. for 5c



**T**HE Sheppard Diesel 7-A Engine direct-connected to this Allis-Chalmers unit provides power to pump 36,000 gallons per hour with a 30 foot head. Fuel cost is 5c per hour. That's a lot of dependable power for a nickel!

This Sheppard Diesel reduces the cost of washing sand, coal, silt, oil field pumping operations. It is also ideal for standby fire protection. That's because complete dependability and readiness to go into action at any moment are assured by Sheppard Diesel's oil cooled

pistons . . . hardened, replaceable cylinder liners . . . 4% governor regulation (closer if required) . . . and, especially, by the simplified Sheppard fuel injection system that stays out of trouble.

What's more, a Sheppard Diesel is not only ready to go into action at any moment—it's ready to go into action the moment you receive it. It's delivered complete. You need only add fuel and water and press the starter button.

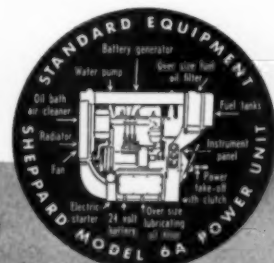
And once you press the starter button on a Sheppard Diesel, you're on the way to learning how low in cost dependable power can be.

We, too, are busy trying to help end this war as speedily as possible. But the reconversion that lies ahead is an important problem and, like other thoughtful industries, Sheppard is planning for it. Sheppard engineers are ready to help you plan your post-war Diesel requirements now. To essential industries, a few Sheppard Diesels are available on priority. Write for information and illustrated data sheet on the Sheppard Model 7-A today.

**R. H. SHEPPARD COMPANY  
HANOVER, PA.**

# *Sheppard*

**ALL AMERICAN  
DIESELS**





# MASSEY GOVERNORS

## NEW TYPE R CENTRIFUGALS

Based on entirely new principles to meet the demand in the field of small and medium size engines for a very close regulating straight mechanical governor which would be small, more powerful and sensitive than anything of its size now available, entirely enclosed and at the same time of rugged construction.

Built in 3 sizes for exacting generator service or wide speed range marine, pump and compressor applications.

Suitable for either horizontal or vertical mounting.

Generator type interchangeable with marine and variable speed types so that same mounting, drive and linkage can be used.

Write for Catalog 44R

Builders of Jahns and Massey Governors For 36 Years

## MASSEY MACHINE COMPANY

783 Pearl St.

Watertown, N. Y.



SIMS TYPE S-B HEAT EXCHANGER

## The Heat Exchanger is Only Part of a Safe Engine Cooling System—

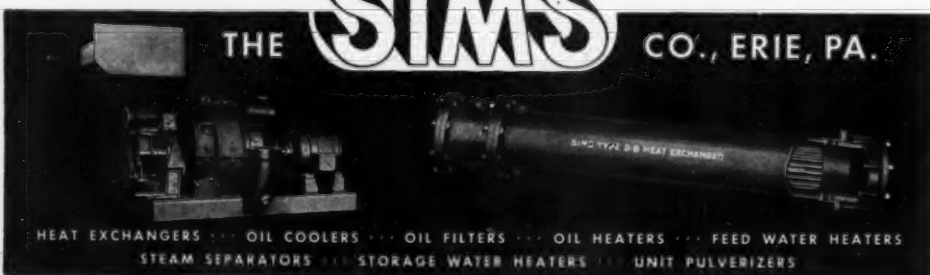
Sims has a wide experience gained in applying heat exchangers in the cooling systems of hundreds of internal combustion engines. Your Diesel Jacket Water Cooling problem may have been worked out many times at Sims—the answer is in our files. Sims has worked with most leading Diesel builders and with users in all parts of the U.S.A. Over 60 years of Sims Heat Recovery experience can help you apply a Sims Heat Exchanger to your Diesel. Give us your problem.

Write for booklet "Heat Recovery No. 2."

# SIMS

THE

CO., ERIE, PA.



HEAT EXCHANGERS ... OIL COOLERS ... OIL FILTERS ... OIL HEATERS ... FEED WATER HEATERS  
STEAM SEPARATORS ... STORAGE WATER HEATERS ... UNIT PULVERIZERS

Penn also manufactures special solenoids for firing aircraft guns mounted on Navy fighter planes as well as a full line of safety controls for Diesel engine application.

## Marley Issues "Refresher" Bulletin On Fundamentals of Water Cooling

ENGINEERS, maintenance men, designers, consultants, and all industrial users of water for cooling purposes will find a new 42-page booklet entitled "Fundamentals of Water Cooling" interesting and of practical value. It discusses basic principles, defines terminology, differentiates types of water cooling equipment and their respective advantages and limitations; then, in nut-shell fashion, details the best modern practice in SELECTION, APPLICATION, and OPERATION of such apparatus. The book is profusely illustrated with photographs, diagrams, and drawings to make each point dramatically clear. Numerous flow charts show typical hook-ups.



View of the front cover and a typical page of the new Marley Bulletin 806.

It is both a pictorialized "refresher course" for the graduate engineer and an understandable working reference for the non-technical man, bringing readers abreast of latest ideas and developments. Available from The Marley Company, Inc., Fairfax and Marley Roads, Kansas City 15, Kansas, upon written request on firm's letterhead. Ask for Bulletin 806.

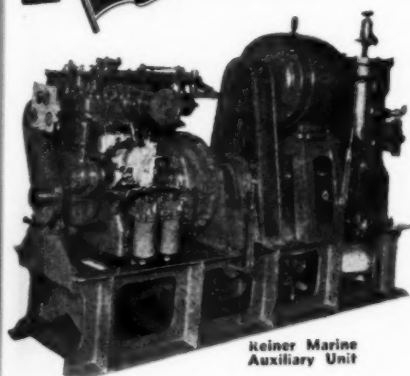
## George Myers Named Assistant Production Superintendent of Perfect Circle Hagerstown Plant

ACCORDING to George H. Keagy, Manager of the Hagerstown plant of The Perfect Circle Company, George Myers has been named Assistant Production Superintendent. Mr. Myers, formerly connected with the Burgess Battery Company of Rockville, Illinois, will be in



# REINER

GENERATING SETS  
and  
AUXILIARY UNITS



Reiner Marine Auxiliary Unit

## Made to Order

You need auxiliary power . . . auxiliary air . . . auxiliary pumping capacity. With a Reiner Auxiliary Unit you don't have to fit your requirements into the "nearest" unit. Rather the above equipment is selected to fit your requirements and then assembled into a compact unit.

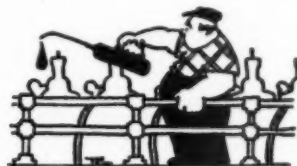
That's what makes Reiner Auxiliary Units the better buy . . . what has influenced such exacting buyers as the Army, Navy, Coast Guard and Maritime Commission to accept Reiner.

JOHN REINER & COMPANY

12-12 37th Avenue  
Long Island City 1, N. Y.

7-RC-1

Assistant to W. E. McCullough, Production Superintendent. Mr. Myers for many years was connected with the Charles E. Bedaux Company, and is a widely known industrial production engineer. He began his duties June 1.



### J. N. Kelly Named Boots Executive

COLONEL N. Jay Boots, President of the Boots Aircraft Nut Corporation and the Fibre Lock-Nut Corporation, has announced the appointment of J. Nelson Kelly as executive vice president of the Fibre Lock-Nut Corporation. Mr. Kelly has been connected with the aviation industry for many years as a pilot and manager of flying operations. He earned his wings with the Army in 1917, flying with Col. Boots in the last war.

He subsequently flew the air mail in its early days, was an aeronautics inspector for the Department of Commerce; a test pilot and was sales engineer for the Aviation Corporation. He became the first manager of Floyd Bennett and the New York Municipal Airport fields and, at one time, was operations manager of Roosevelt Field.



J. Nelson Kelly

### Penn Appoints O. G. Tinkey St. Louis Branch Manager

OTTO G. TINKEY was recently employed by Penn Electric Switch Co., Goshen, Ind., as manager of the company's St. Louis branch office

## SPECIFY HILCO

FOR LUBRICATING OIL PURIFYING

A complete line of lube oil purifiers using Fullers Earth - cotton waste and specially prepared filtering agents.

### HILCO OIL RECLAIMERS

A simple, economical and foolproof method of restoring contaminated oil to the full value of new oil - for direct connecting to one or more Diesel engines for continuous or intermittent operation.

### HILCO HYFLOW OIL FILTERS

A superior oil filter for perfect filtering of Diesel engine lube oil - for direct-connecting to one or more engines - continuous or intermittent operation.

### HILCO AIRLINE OIL PURIFIERS

A perfect method for contact oil purifying for complete oil reconditioning. For batch purifying directly from engine lube oil system or transfer tanks.

The Hilco line offers you a complete lubricating oil purifier service. Write today for free literature and see what Hilco operators are doing - then let us help you select a Hilco to take care of "That Particular Job."

OIL PURIFIER HEADQUARTERS

THE HILLIARD Corporation

122 W. 4th ST., ELMIRA, N. Y.

## "Periodic Re-tightening NOT Necessary with BOOTS NUTS," say leading fleet operators

**Operators of 100,000 MOTOR VEHICLES**

indicated, in a recent survey, that if a vibration-proof nut, like this, were standard equipment on their post-war passenger cars, trucks and buses, tens of thousands of dollars for maintenance and repairs would be saved.

The ALL-METAL LOCK is Built in Here





Proved invaluable by United Parcel Service



Tested successfully by R. H. Macy & Co.



Endorsed by Metropolitan Distributors, Inc.

ACTUAL service tests by leading fleet operators have proved that this nut really stays put. It can't shake loose.

With its built-in all-metal lock, the Boots Nut will be available to you to assure fewer repairs and better all-round performance, as shown in service tests by R. H. MACY & COMPANY, UNITED PARCEL SERVICE, METROPOLITAN DISTRIBUTORS, INC., and others. There'll be no excuse for a nut shaking loose!

temperatures or weather.

For the duration, Boots' entire output must be reserved for military aircraft. After victory, the Boots Nut will be available to you to assure fewer repairs and better all-round performance, as shown in service tests by R. H. MACY & COMPANY, UNITED PARCEL SERVICE, METROPOLITAN DISTRIBUTORS, INC., and others. There'll be no excuse for a nut shaking loose!

### BOOTS SELF-LOCKING NUTS

*"There's No Excuse for a Nut Shaking Loose"*

Boots Aircraft Nut Corporation  
General Offices, New Canaan, Conn.

located at 4030 Chouteau Ave. Mr. Tinkey, a graduate electrical engineer, has had more than twenty years of engineering and selling experience in the commercial refrigeration and heating markets.



Otto G. Tinkey

Before joining Penn, Mr. Tinkey was the St. Louis representative for Copeland Refrigeration Company and was also engaged as consulting engineer for various St. Louis manufacturers.

### West Coast Diesel News

By JIM MEDFORD

**ANOTHER** Cummins Diesel will be installed in the Star and Crescent fleet, San Diego, California. Of 125 hp., the new 50-foot tug will have Ross heat exchanger, Twin Disc gears, Lambie wheel, Cuno and Nugent filters.

**MADDEN & Lewis** yard, Sausalito, California, have a contract for several small Navy tugs, 66 feet. Buda Diesels of 150 hp., in pairs, have been selected for main drive.

**THE** San Pedro, California, yard of the Western Pipe & Steel Co. recently delivered a 174-foot, 7000-barrel Navy tanker with 600 hp. Union Diesel, Cummins Diesel auxiliaries, Waterous pumps and Rogers Diesel generator sets.

**HARBOR** Boat Co.'s Fish Harbor yard, California, latest launching is 500 hp. G.M. Diesel




**FOR VICTORY BUY UNITED STATES WAR SAVINGS BONDS AND STAMPS**

# IMITATED BUT NEVER EQUALED

Since the days of the first HALL ECCENTRIC Valve Seat Grinder and HALL Wet Type Valve Refacer this equipment has been often imitated . . . but never has this equipment been equaled in principle, precision, finish, ease of operation, moderate first cost, low operating and maintenance cost, long-life and availability of service parts; the patented HALL features of this equipment have never been even closely imitated . . . That's why it will pay you to contact your nearest HALL Jobber today or write the factory as to the availability of HALL Valve Servicing Equipment as used by engine builders, thousands of service shops, car and truck dealers, fleet shops, bus operators, air transport companies and allied army and navy bases.

**The Hall Manufacturing Co.**  
Toledo 7, Ohio, U. S. A.

# HALL





Tinkey, a more than ing experi- and heat.

engined minesweeper; Joe's gears, Harrison heat exchangers, Gardner-Denver compressors, Briggs lube and AC fuel filters, Brown pyrometers, Burgess air filters, G.M. Diesel auxiliaries.

**BUILT** in an open field, the Army's 175-foot coasters are engined with twin General Motors 500 hp. V-12 Diesels with Falk reduction gears, and 42 hp. Superior Diesel-generator set.

**CONVERTED** to production of fishing vessels after completion of war contracts, the North American of Newport Harbor, California, has launched a new 61-foot, 50-ton dragger for Castagnola Bros., of Santa Barbara; engined with 155 hp. Atlas Imperial marine Diesel.

**PEYTON'S** Newport Harbor, California, yard has completed installing a new 100 hp. Buda marine Diesel in the schooner *Bali* for Mike O'Shey, national writer. Freighter to Mexico, is the report, but it indicates a trend.

**THE** second 90-foot wooden clipper is under way at San Diego (California) Marine Construction; engine is a 320 hp. Atlas Imperial marine Diesel; auxiliaries, two 80 hp. Atlas Diesels and G.E. 40 kw. generators; refrigeration by Baker.

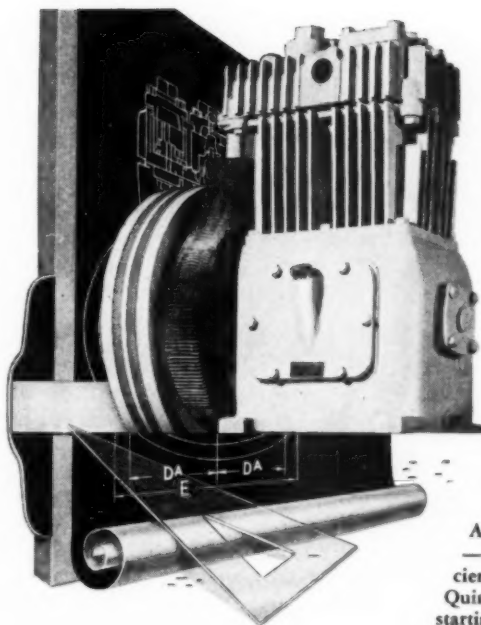
**FOR** Lou Strada and associates, the Lynch yard at San Diego, California, is constructing another 96-footer for the tuna fleet; main engine is an 8-cylinder 12 x 15, 525 hp. at 400 rpm. Enterprise Diesel.

**ANOTHER** Diesel installation goes to Billante Brothers, San Francisco. A 350 hp. Enterprise Diesel in the *Anna B* recently returned to owners by the Navy. Martinolich, builder, is doing the repowering.

**AT** Terminal Island, California, Al Larson will build a 105-foot tuna clipper for Van Camp Sea Food Co., with Atlas Imperial main marine Diesel of 400 hp., and a pair 120 hp. Atlas Diesels with G.E. generators of 94 kva. for ship's auxiliary power.

**DUMM** Brothers will take delivery of a 65-foot seiner at Hodgeson-Greene-Haldeman, Long Beach, California, yard; 150 hp. with a Lorimer Diesel, main engine, and Caterpillar Diesel "25's" will handle generators and refrigeration.

**CURTOLA** Marine Ways, Oakland, California, have completed the 50-foot shark fisherman for the LaRocca & Sons fleet, now numbering eight boats; this latest engine is an 80 hp. Fairbanks-Morse Diesel.



*Designed  
FOR  
Tomorrow*

**...HERE TODAY**

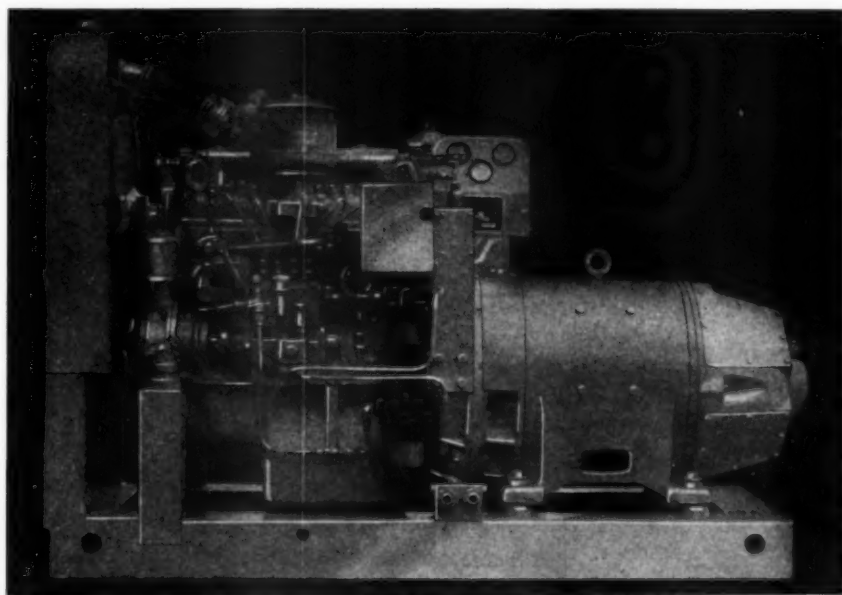
Advanced design — both inside and out — accounts for the greater over-all efficiency, compactness and eye-appeal of Quincy Compressors. Put them to work starting Diesels . . . operating brakes . . . actuating pneumatic controls . . . and on other services requiring intermittent pressures up to 500 lbs. per sq. in. Quincy makes air compressors *exclusively* . . . call in a Quincy *specialist*.

**Quincy**  
COMPRESSORS

QUINCY COMPRESSOR CO., QUINCY, ILLINOIS

Branch Offices:

New York • Chicago • St. Louis • San Francisco



**ENGINE GENERATOR SETS  
5 KW. TO 100 KW.**

**Duplex Truck Co.**  
Lansing, Michigan

as the St. Refrigerated as con- is manu-

A D

e installed iego, Cali- t tug will Disc gears. ters.

California. y tugs, 66 pairs, have

the West- red a 174- 600 hp. auxiliaries. generator

yard, Cali- M. Diesel-

GRESS

## Highest Quality Gaskets & Oil Seals by **FITZGERALD** Gasket Craftsmen for 38 Years

Gaskets of all types and materials to give reliable service under all Diesel operating conditions.

For full information write —

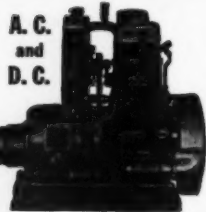
**THE FITZGERALD MANUFACTURING  
COMPANY**  
TORRINGTON, CONN.

Branches: Chicago, Illinois, Los Angeles, California  
Canadian FITZGERALD, Limited, Toronto

**FITZGERALD**  
SINCE 1906 **GASKETS**  
THE COMPLETE LINE THAT COMPLETELY SATISFIES

## WITTE DIESELECTRIC PLANTS

The finest Dieselelectric Plants ever to carry the WITTE name will be ready for you after victory . . . to supply power and light at amazingly low cost. Over 74 years manufacturing experience contributes to their reliability. Mechanical improvements are being continuously developed and mass production is reducing production costs. Today Witte Units are serving the victory cause all over the world.



**WITTE ENGINE WORKS**  
LARGEST BUILDER OF SMALL DIESELS  
KANSAS CITY, MO., U. S. A.



## CHRONOMETRIC TACHOMETER NEW MODEL HIGHEST ACCURACY

Readability to 1 RPM per division. Guaranteed accuracy well within 1/2 of 1%. Indicates RPM directly on the dial without any calculations over a fixed period of 6 seconds. Negligible torque. Two models available as follows:

Cat. No. 2301, 0-10,000 RPM, suitable up to 20,000 RPM.  
Cat. No. 2302, 0-1000 RPM, suitable up to 2000 RPM.

Come in three models with various accessories.

Write for bulletin No. 715-D

HERMAN H.

**Sticht**

COMPANY, INC.  
NEW YORK 7, N. Y.

27 PARK PLACE

IN THE *China Hat*, B. C. Packers' seiner-packer, there's a Murphy Diesel of 150 hp. She was built at the company's Celtic shipyard, Vancouver, B. C.

ON THE Oregon coast at Tillamook, the Steinbach Iron Works has delivered the last of its contracted 65-foot tugs to the U. S. Maritime Commission. The engines are single 230 hp. Superior Diesels.

SWITCHING to fishing vessels, the Channel Boat Co., Newport Harbor, California, is completing a 46-foot fisherman for John Zanich of San Pedro. Power plant is a 70 hp. Caterpillar Diesel.

FOR a partnership of San Francisco men, the Channel Boat Company will also construct three 51-footers with 115 hp. Caterpillar Diesels carrying fuel sufficient for 300 hours of operation, 2000 gallons.

PUGET Sound Freight Lines have acquired the old *K. L. Ames*, formerly an Alaskan cannery tender, remodeled her and installed a pair of 180 hp. Washington Diesels for freight handling.

A GANDER at the B. C. logging industry tells us the tug *Debe* of Dumarsq Brothers, Vancouver, B. C., is now powered with a new Cummins 100 hp. Diesel, a favorite in the heavy tides.

THE new Seattle, Washington, yard of Treutle Marine Ways has launched its first vessel, a 80-foot seiner for Alaska Pacific Salmon Co. Main engine, a 320 hp. Atlas Imperial Diesel.

AT THE same Seattle yard there are now under construction four seine boats of 52 feet to be powered with 100 hp. Mack marine Diesels. Treutle was formerly located at Kordova, Alaska.

## CONTACT MAKERS



## ENGINE ALARM SYSTEMS

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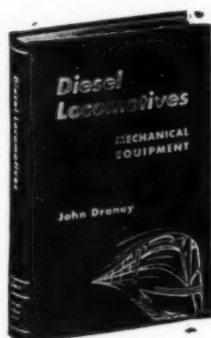
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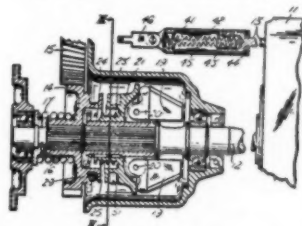
*A description of the outstanding patented in-  
ventions on Diesel and Diesel accessories as they  
are granted by the United States Patent Of-  
fice. This information will be found a handy  
reference for inventors, engineers, designers and  
production men in establishing the dates of  
record, as well as describing the important  
Diesel inventions.*

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**2,326,888**

### CONTROL OF FUEL INJECTION ENGINES

Arthur Freeman Sanders, Leeds, England, as-  
signor of one-half to John Fowler & Co.  
(Leeds) Limited, Leeds, England  
Application August 7, 1941, Serial No. 405,880  
In Great Britain April 5, 1941  
9 Claims. (Cl. 123-140)

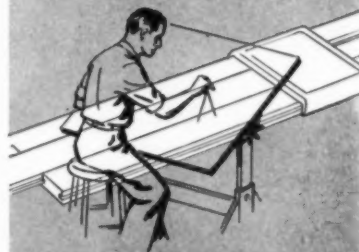


1. The combination with a variable-speed,  
fuel-injection engine, of a speed-responsive gov-  
ernor driven from the engine, the governor in-  
cluding an endwise-located spindle, a fuel pump  
driven by said spindle, an axially-movable part  
in the drive from the engine to said spindle, a  
driving part, said axially-movable part being po-  
sitioned axially by the governor weights and  
having a screw-threaded engagement with said  
driving part whereby said spindle will be angu-  
larly advanced or retarded with respect to the  
engine dependently upon the position of the  
governor weights, and manual and automatic  
means also connected to said part so that the  
latter can be positioned axially thereby inde-  
pendently of the governor action.

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torial material with a cross index of authors  
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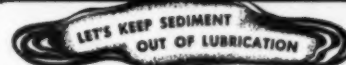
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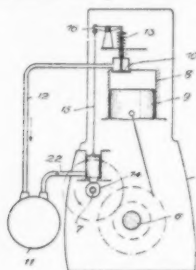
Application for Membership in the Diesel Engineers International Assn.  
576 Newark Ave., Jersey City, N. J.

Name .....

Address .....

Reference .....

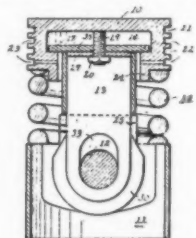
2,322,978  
DEVICE FOR WITHDRAWING BRAKE AIR FROM DIESEL ENGINE CYLINDERS  
Karl Schwaiger, Gaggenau, Baden, Germany;  
vested in the Alien Property Custodian  
Application March 29, 1940, Serial No. 326,610  
In Germany March 29, 1939  
4 Claims. (Cl. 230-24)



1. The combination comprising an internal combustion engine of the type having at least one cylinder in which a gaseous medium is compressed by a piston and is then ignited, a tank, a conduit leading from said cylinder to said tank to supply some of said compressed medium thereto, a valve controlling said conduit, means intermittently operated by said engine and adapted to positively open said valve at the end of the compressing stroke of said piston before the compressed medium will be ignited, and means responsive to the pressure in said tank and adapted, when the same surpasses a predetermined limit, to render said valve-opening means inoperative.

2,323,742  
INTERNAL COMBUSTION ENGINE PISTON  
Philip S. Webster, Muskegon, Mich.  
Application March 19, 1942, Serial No. 435,272  
4 Claims. (Cl. 309-15)

1. A piston for an internal combustion engine having an upper portion and a lower portion in spaced relation thereto having vertically spaced side walls whose lower ends are each provided



with a shoulder, a connecting member secured to the upper portion of the piston and limitedly slidably disposed within the lower portion thereof whose lower ends are flared outwardly and are adapted to engage said shoulders, and a helical expansion spring interposed between the upper and lower portions of the piston.

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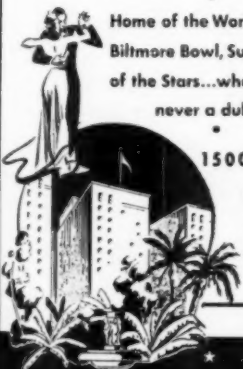
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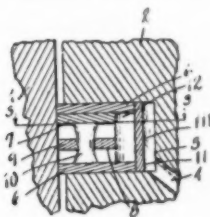


LOS ANGELES, CALIFORNIA

2,317,637

### PISTON RING

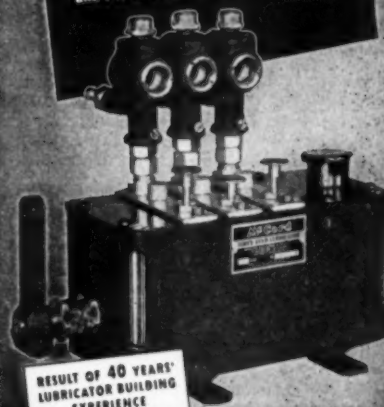
Harold P. Phillips, Hastings, Mich., assignor to  
Hastings Manufacturing Company, Hastings,  
Mich., a corporation of Michigan  
Application March 11, 1940, Serial No. 323,273  
12 Claims. (Cl. 309-45)



1. A piston ring assembly, comprising a pair  
of thin, flat, annular, split cylinder wall engag-  
ing side members of wear resisting material, an  
intermediate thin flat split annular cylinder wall  
engaging element disposed in side by side rela-  
tion to the upper of said side members, a spacer  
disposed between said intermediate member and  
the lower side member, said spacer comprising  
a thin, annular, split cylinder wall engaging  
member having a plurality of circumferentially  
spaced rivet-like members disposed therethrough  
to coact with said intermediate member and the  
lower side member, and an annular spring ex-  
pander having a plurality of crimps therein, cer-  
tain of which are in coacting thrust relation to  
said side members and others of which are of  
reduced axial width to extend between said side  
members and coact with the said intermediate  
member and said spacer member and to consti-  
tute supplementary spacing members for said

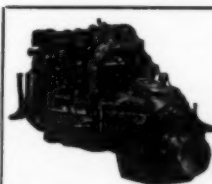
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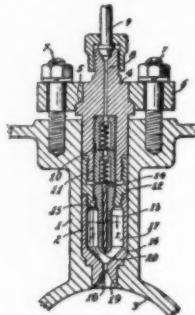
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2,316,887  
**FUEL INJECTION SYSTEM**  
Walker M. Pate and Harvey E. Burgdorf,  
Ferguson, Mo.  
Application November 6, 1939,  
Serial No. 303,002  
2 Claims. (Cl. 123-32)



1. In a fuel-injection system for an internal combustion engine of the character described having a cylinder provided with a combustion chamber, a fuel-injection unit removably mounted in the engine comprising, a body having means for attachment to the engine and having a fuel duct therethrough, means on said body providing an air chamber having a restricted passage for access thereto, and a fuel nozzle on said body projecting into said chamber to be immersed in the air therein and having a fuel duct connected with said duct through said body, the tip of said nozzle being positioned and arranged within said storage chamber but close enough to said passage to project its fuel jet through said passage to be ignited therebeyond.

2,323,310  
**PISTON**  
Cornelius S. Clark, Norfolk, Va.  
Application January 28, 1942, Serial No. 428,611  
19 Claims. (Cl. 123-176)

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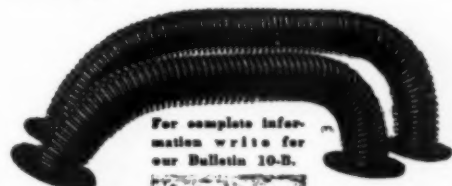
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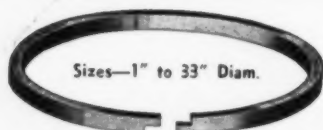


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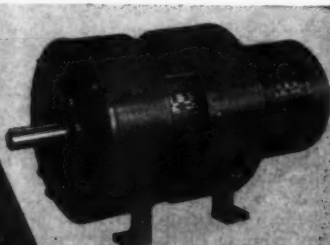
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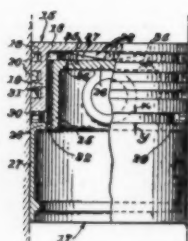
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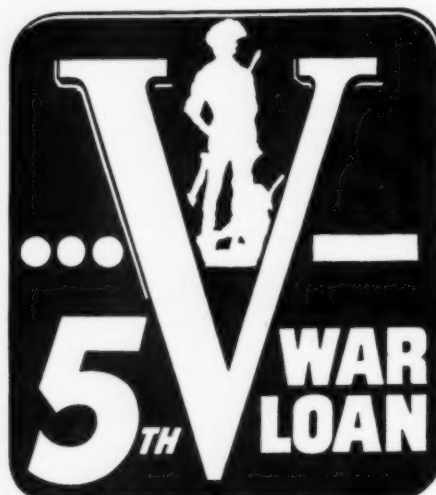
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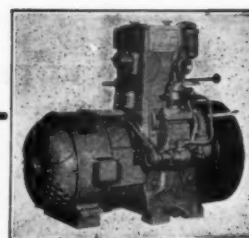
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